Return SC Bldg
Sidney
Musgrove

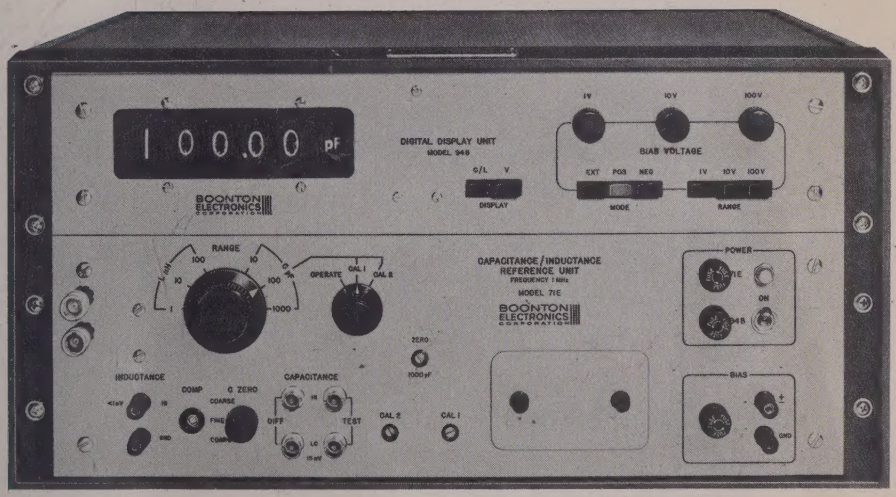
71E
94B

BOONTON ELECTRONICS CORPORATION

# OPERATOR'S MANUAL

for

# DIGITAL C/L METER MODEL 700C




700C
a-470


BOONTON ELECTRONICS CORPORATION

TEL: 201-887-5110
TWX: 710-986-8241
ROUTE 287 AT SMITH ROAD
PARSIPPANY, N. J.— 07054

Table 1. Technical Characteristics (Cont'd)

| | |
|---|---|
| Voltage monitory accuracy | ± 0.1% of rdg ( ± 2 digits ) |
| Regulation | Limits at approximately 10 mA on any of the three ranges. |

Digital Display Unit:

| | |
|---|---|
| BCD Output | 4-line (8,4,2,1), where logic 1 ≥ 4 V and logic 0 ≤ 0.4 V |
| Power Requirements | 117 V or 234 V, ± 10%; 50 to 60 Hz |
| Power Consumption | 42 watts |
| Dimensions | 19-1/2" wide, 9-7/8" high, 17-7/8" deep |
| Weight | 41 lbs. |

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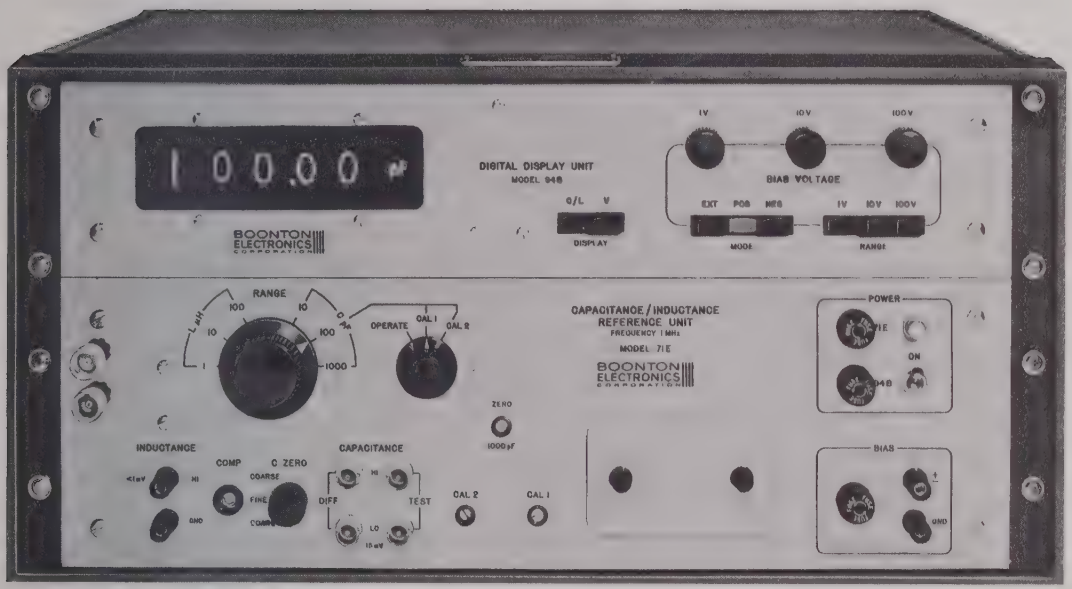



Figure 1. Digital C/L Meter Model 700C

# CHAPTER 1

## DESCRIPTION AND DATA

1.1 PURPOSE AND DESCRIPTION. The Digital C/L Meter, Model 700C, Figure 1, is a self-contained, digital type test equipment used to perform precise measurements of three-terminal capacitance specimens and two-terminal inductance specimens at 1 MHz. The 700C also provides and measures a dc bias voltage that is variable in three separate ranges: 0 to ± 1.3999 V, 0 to ± 13.999 V, 0 to ± 139.99 V. All measured values are illuminated and displayed on a digital type indicator. Test specimens may be connected to the 700C by means of coaxial cables and a test jig, or they may be connected directly to the front panel terminals. A pair of BNC-to-binding-post adapters are stored on the front panel to facilitate direct connections to the 700C. An internal 100 pF capacitance standard is used to calibrate the 700C. A binary coded decimal (BCD) output, available at a rear panel printed circuit connector, permits the 700C to be used in system applications for driving printers, tape or card punches, data control units, and similar interfacing data equipment.

1.2 MODEL 700C CONFIGURATION. The Digital C/L Meter, Model 700C, consists of Capacitance/Inductance Reference Unit 71E, and Digital Display Unit/Bias Supply Model 94B. The 71E unit provides the measuring functions, supplies the 1 MHz test signal, and contains the 100 pF capacitance standard. The 94B unit computes the measurement and displays it as a plus or minus numeric readout along with the applicable measurement mode symbol. The 94B provides an accurate readout up to 140% of full-scale for each measurement range. However, a fifth digit is displayed from 100% to 140% of full-scale. If the 40% overrange tolerance is exceeded, the digital display will blank out and an OVERRANGE warning will be displayed until the RANGE switch is advanced to a higher measurement range. The 94B Bias Supply is used to apply a variable ± 140 V internal bias voltage between the 71E CAPACITANCE HI and LO terminals (and across any specimen connected either to the TEST or the DIFF terminals). If a bias voltage greater than 140 V is required, the internal supply can be bypassed and an external dc source, up to ± 200 volts, may be connected to the 71E BIAS terminals. The 700C measures and indicates only up to ± 140 V dc, and neither the internal nor external bias appears across the INDUCTANCE terminals.

1.3 MEASUREMENT CONSIDERATIONS. The 700C ignores stray capacitance from the LO post to ground and measures the capacitance value of the test specimen only. The stray capacitance from the HI post to ground has no significant influence above 10 pF, and the effects of stray capacitance below 7 pF can be negated by the 71E COMP adj control. The COMP adj control also is used to negate the capacitance introduced by coaxial cables during remote measurement, and the direct capacitance introduced by a test jig can be balanced out by the 71E C ZERO control. Thus, specimens can be connected either locally or remotely to the 700C without incurring errors caused by capacitance from either side of the test to ground. However, when coaxial cables are used to connect specimens to the 700C, the effects of series inductance introduced by the cables must be taken into consideration because erroneous readings can result. The correction for series inductance errors is a simple procedure and is discussed in paragraphs 3.9 and 3.11.

1.4 TECHNICAL CHARACTERISTICS. The characteristics of the Digital C/L Meter, Model 700C, are shown in the following table.

Table 1. Technical Characteristics

## MEASUREMENT AND OTHER CHARACTERISTICS

**Capacitance Measurements (3-terminal):**

Range ..... 0 to 1000 pF

Accuracy ..... 0.25% of reading + (0.1% + $\frac{3}{Q}$ %)fs
+ 0.002 pF

Where: Q = Q of test specimen

Resolution ..... 4 digits

**Inductance Measurements (2-terminal):**

Range ..... 0 to 100 μH

Accuracy ..... 0.5% of reading + (0.5% + $\frac{6}{Q}$ %
+ $\frac{L\mu H}{500}$ %)fs +0.0005 μH

Where: $L_{\mu H}$ = test specimen inductance
Q = Q of test specimen

Resolution ..... 4 digits

**Test Signal:**

Frequency ..... 1 MHz, crystal controlled, ± 0.02%

Level:

Capacitance measurements....15 mV, rms, ± 1 mV

Inductance..... < 1 mV, rms

**Bias Supply:**

Internal bias..... 0 to ± 139.99 V, continuously variable, in three ranges: 0 to 1.3999, 0 to 13.999, 0 to 139.99, fused, & digitally monitored

External bias ..... Up to ± 200 V at 250 mA may be applied at fused BIAS terminals; 0 to ± 139.99 V digitally monitored.

Table 1. Technical Characteristics (Cont'd)

| | |
|---|---|
| Voltage monitory accuracy | ± 0.5% fs ( ± 2 digits) |
| Regulation | Limits at approximately 10 mA on any of the three ranges. |

Digital Display Unit:

| | |
|---|---|
| BCD Output | 4-line (8,4,2,1), where logic 1 $\geq$ 4 V and logic 0 $\leq$ 0.4 V |
| Power Requirements | 117 V or 234 V, ± 10%; 50 to 60 Hz |
| Power Consumption | 42 watts |
| Dimensions | 19-1/2" wide, 9-7/8" high, 17-7/8" deep |
| Weight | 41 lbs. |

Never touch Read adj

| Range Sw | | |
|---|---|---|
| Between 10 & 100 | 0 | Dum Zero on rear<br>zero for S. approx<br>Comp for peak<br>Zero for Zero |
| 1000 → 10 | | Zro for Zero<br>Zro for Zero |
| 100 | | CAL 1 for 100<br>CAL 2 for 100 |
| 100 | | operate position with 100 pf in should read 100. If it doesn't make it read 100 with CAL 1. Go Back to CAL 1 pos & adjust thru S~~cre~~hole atop CAL 2 switch position Adjustment to make meter read 100. With std Buttons Released (Zero pf) in. |

Book on 71A has better cal procedure

Check 10 pf range in operate pos and also 1000 pf & make adjustments thru front panel (Right side) holes) DO NOT use hole at any time marked 100PF.

## CHAPTER II
## INSTALLATION

2.1 UNPACKING AND INSPECTION. Remove the packing material from the shipping carton and carefully remove the 700C. If feasible, the carton and packing material may be stored for possible future reshipment. Carefully inspect the 700C for any damage that may have occurred during shipment. If there is any damage or defect, notify either your local Sales Engineering Representative or the Boonton Electronics Corporation.

2.2 PACKING FOR RESHIPMENT. If required, pack the 700C for reshipment to the manufacturer in accordance with the following shipping instructions:

a. If possible, use the original shipping carton and packing material.

b. Coil the power cable inside the rear panel compartment.

c. Tie a tag or envelope to the BIAS binding post and include the following information:

(1) Name and address of purchaser.

(2) Model number and serial number of equipment.

(3) Full description of damage or defect.

2.3 POWER CONNECTIONS. Check to see that the ac power source is the same as that specified on the equipment nameplate, and connect the power cable plug to a power receptacle.

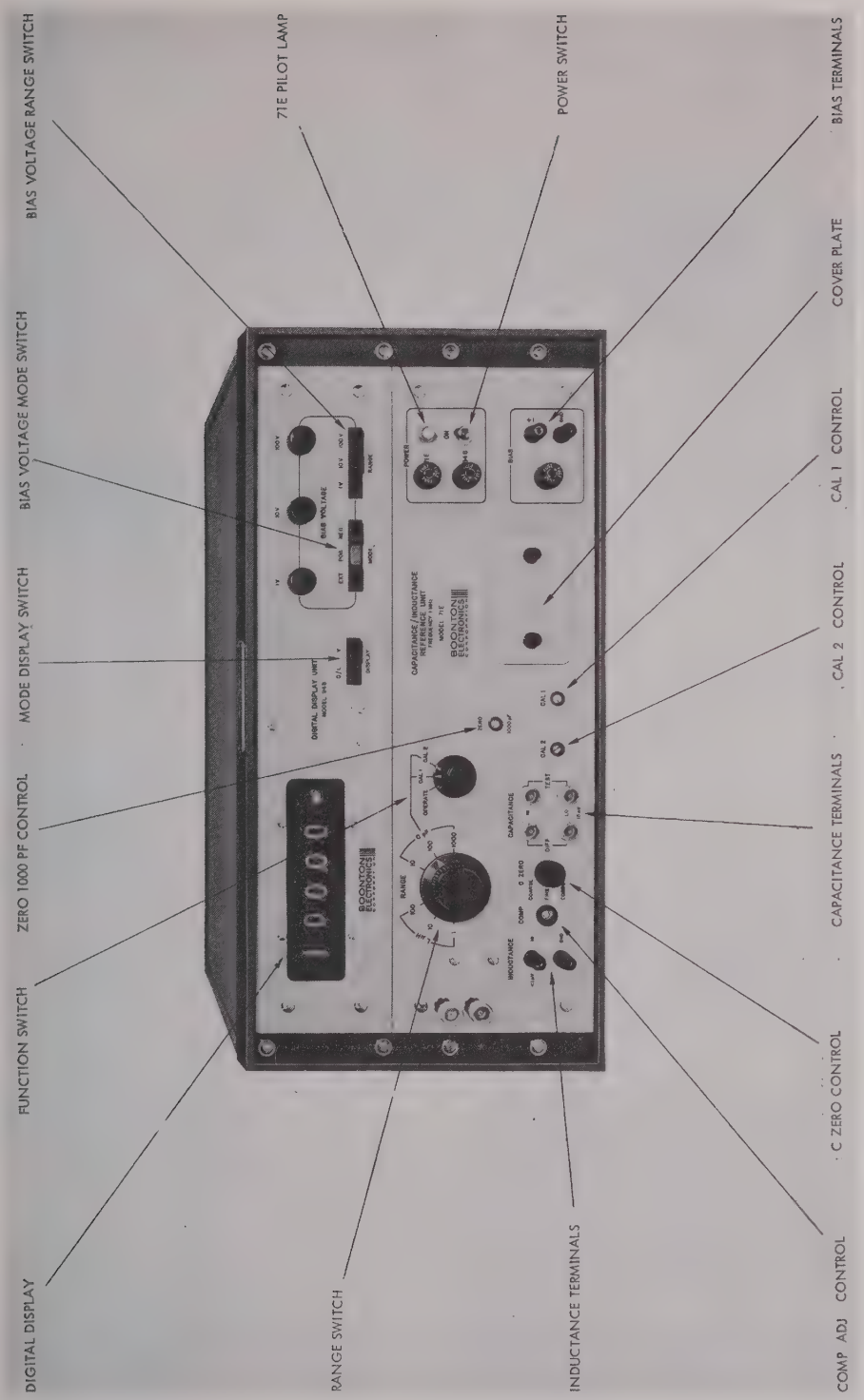



Figure 2. Model 700C Controls and Indicators

# CHAPTER III

## OPERATION

3.1 GENERAL. This chapter contains operating instructions for the 700C and includes procedures for capacitance (C) and inductance ( L ) measurements, bias application, C differential measurements, correcting for external cable inductance, and calibrating the 700C. Before attempting any measurements, observe the preliminary operating instructions in Part I, below.

## PART I. PRELIMINARY OPERATING INSTRUCTIONS

3.2 CONTROLS AND INDICATORS. The controls and indicators of the 700C are illustrated in Figure 2 and are functionally described in Table 2. Thoroughly review the function of each item in the table before performing any adjustments or measurements on the 700C.

Table 2. Controls and Indicators

| COMPONENT | DESCRIPTION - FUNCTION |
|---|---|
| 71E Unit: | |
| INDUCTANCE HI and GND terminals | Binding posts used to connect inductors to the 700C. |
| RANGE switch | 7-position rotary switch used to select measurement mode and range. LμH 1, 10, and 100 positions used for inductance measurements, and CpF 10,100, and 1000 positions used for capacitance measurements. Top-center position can be used to check DVM zero. |
| Function switch | 3-position rotary switch designated as OPERATE, CAL 1, and CAL 2. The OPERATE position is used when measuring capacitance or inductance. The CAL 1 and CAL 2 positions respectively provide a high-Q and low-Q internal 100 pF capacitance standard for calibration. |
| CAPACITANCE TEST HI and LO terminals | BNC connectors used to connect capacitance specimens to the 700C. Specimens may be connected directly (using BNC-to-binding-post adapters discussed below) or remotely by means of coaxial cables and a test jig. |

Tabel 2. Controls and Indicators (Cont'd)

| COMPONENT | DESCRIPTION-FUNCTION |
|---|---|
| CAPACITANCE DIFF HI and LO terminals | BNC connectors used to connect capacitance specimens to the 700C, as discussed above. A capacitance connected to the CAPACITANCE TEST terminals produces a positive reading, while the same capacitance connected to the CAPACITANCE DIFF terminals causes a comparative negative reading. The CAPACITANCE DIFF terminals are used to make differential capacitance measurements, and to extend the range of the C ZERO control. |
| BNC-to-binding-post adapters | Adapters are stored on the 71E front panel to be used to connect test specimens directly to the CAPACITANCE TEST or DIFF terminals. |
| C ZERO control | Continuously variable control used to balance out capacitance introduced across the CAPACITANCE terminals by connecting leads or a test jig. The C ZERO control can neutralize up to approximately 7 pF of cable or jig capacitance, but its range may be increased by connecting an external capacitance to the CAPACITANCE DIFF terminals ( par. 3.12). For about 270 degrees of rotation, the C ZERO control turns easily, and then the torque requirement increases sharply as the control shifts from a 36:1 FINE ratio to a 6:1 COARSE ratio. |
| ZERO 1000 pF control | Screwdriver-adjust control used to zero the 1000 pF position of the RANGE switch. Proper alignment of the 1000 pF RANGE switch circuit is essential for accurate measurements of both capacitance and inductance. The 1000 pF position on the RANGE switch should be checked periodically. The ZERO 1000 pF control has the same vernier drive described for the C ZERO control, above. |
| COMP adj control | Screwdriver-adjust control used to negate stray capacitance between the inner conductors of the CAPACITANCE TEST |

Table 2. Controls and Indicators (Cont'd)

| COMPONENT | DESCRIPTION - FUNCTION |
|---|---|
| | and DIFF HI BNC connectors and the outer conductors. The COMP adj control can tune out approximately 100 pF. Normally, stray capacitance is balanced out on the 10 pF range only, because the amount of stray capacitance required to cause a 1% error is more than two times the full-scale of the range used. When measuring on the 10 pF range, adjust the COMP adj control under the following circumstances:<br>a. When the 700C is first operated.<br>b. When the specimen connection system is changed (e.g., from cables or test jig to direct connection).<br>c. When measuring a capacitance standard.<br>d. When a specimen has a markedly different HI-post-to-ground capacitance (caused by different internal construction, encasing, or terminations) than specimens measured previously. |
| BIAS terminals | Binding posts used to connect external bias voltages, up to ± 200 volts at 250 mA, to the 700C. The applied bias voltage appears across the CAPACITANCE TEST and DIFF terminals but not across the INDUCTANCE terminals. The digital display will readout external bias up to 140 V( 100 V+ 40% overrange) if mode switch is at EXT, DISPLAY switch is at V (voltage), and RANGE switch at appropriate voltage. |
| BIAS fuse | 250 mA fuse in the external-bias input circuit. |
| CAL 1 control | Screwdriver-adjust control (10 turn) used in conjunction with the function switch CAL 1 position to calibrate the 700C at 100 pF for high Q (>10) measurements. |
| CAL 2 control | Screwdriver-adjust control (multi-turn) used in conjunction with the function |

Table 2. Controls and Indicators (Cont'd)

| COMPONENT | DESCRIPTION - FUNCTION |
|---|---|
| | switch CAL 2 position to calibrate the 700C at 100 pF for low Q (Q=3) measurements. |
| Power switch | Toggle switch used to control ac power for the 700C. |
| Pilot Lamp | Glows when the 700C is energized. |
| 71E FUSE | Protects 71E |
| 94B FUSE | Protects 94B |
| C10, C100, C1000, L1, L10, L100 controls | Screwdriver-adjust controls accessible when front panel cover plate is removed. Each control is labeled to correspond with a RANGE switch position, and the control is used to calibrate the designated switch position. These controls are preset at the factory and should not require adjustment. |
| 71E Rear Panel: | |
| COARSE CAL 2 control | Screwdriver-adjust control, functions as a coarse adjustment for front panel CAL 2 control. |
| R415 control | Screwdriver-adjust control used to adjust operating point of internal circuits. This control is preset at the factory and should not be touched. |
| 94B Unit: | |
| Digital display | Nixie-tube indicators provide + or - numerical readout with the appropriate measurement mode symbol. Four digits are displayed from .0000 to 99.99% of full scale for each RANGE switch setting, and a fifth digit is displayed above 99.99% of full scale. An OVERRANGE warning is activated when the readout reaches 40% above full scale. If the 40% tolerance is exceeded, the readout will blank out. |
| 94B Front Panel: | |
| Display Switch | Selects either C/L voltage from 71E or bias voltage from internal or external supply. |

Table 2. Controls and Indicators (Cont'd)

| COMPONENT | DESCRIPTION - FUNCTION |
|---|---|
| Mode switch | Selects + or - internal bias or external bias. |
| Voltage range switch | Three-range switch used to establish maximum output of bias voltage level at either 1 V, 10 V, or 100 V. Also sets the range for the digital display when measuring external bias. |
| 1 V, 10 V and 100 V level controls | Used to vary the level of the bias supply output within the limit established by the voltage range switch position. Fully clockwise position produces maximum bias level. |

3.3 INITIAL CONTROL SETTINGS AND WARM-UP. Set the 700C controls (Figure 2) in accordance with Table 3, below, and allow at least two hours for warm-up from normal room temperature before proceeding to the pre-operational adjustments in paragraph 3.4.

Table 3. Initial Control Settings

| COMPONENT | SETTING OR CONDITION |
|---|---|
| 71E Front Panel: | |
| RANGE switch | 10 pF |
| Function switch | OPERATE |
| Power switch | ON (71E pilot lamp glows) (digital display unit indicates). |
| INDUCTANCE, CAPACITANCE, and BIAS terminals | Free of any specimen or connection |
| 94B Front Panel: | |
| Display switch | C/L |

3.4 PRE-OPERATIONAL ADJUSTMENT. Before making the following adjustments, check that the 700C has warmed up for at least one hour and that the settings and conditions of Table 3 have been observed.

a. Set RANGE switch to vertical position between LμH and 0 pF and check digital display unit zero indication. ( If necessary, use zero controls on rear of 94B)

b. Return RANGE switch to 10 pF position.

c. If the BNC-to-binding-post adapters and/or a test jig will be used to connect capacitance specimens (par. 3.8) connect the adapters, jig, or connecting cables as required to the CAPACITANCE TEST HI and LO terminals on the 71E.

d. Adjust the C ZERO control on the 71E until the digital display reads approximately 7.500 pF.

e. Peak the COMP adj control for a maximum reading on the digital display. If the digital display should indicate OVERRANGE, readjust the C ZERO control until the display is on range, and repeak the COMP adj control.

f. Adjust the C ZERO control for a readout of as close to zero as possible. If the BNC-to-binding-post adapters are installed on the CAPACITANCE TEST terminals, minimize operator proximity to the adapters. Hand- or body-capacitance effects may cause variations in readings during the C ZERO adjustment.

g. Set the RANGE switch to 1000 pF and adjust the ZERO 1000 pF control for a readout of zero.

h. Set the RANGE switch to 10 pF and check that the digital readout is as close to zero as possible. If the readout is not near zero, repeat steps d through h.

NOTE:

The proper adjustment of the ZERO 1000 pF control is essential for accurate C and L measurements. During operation, check the 1000 pF Range position occasionally for a readout of zero. If the readout is not at or near zero, perform steps d through h, above.

i. Perform the calibration procedures in paragraphs 3.5 and 3.6, below.

3.5 CAPACITANCE CALIBRATION WITH INTERNAL STANDARD. A 100 pF internal capacitance standard is provided for calibrating the capacitance-measuring circuits in the 700C. This is a three-terminal, 1 MHz standard, and provides calibration options for both high-Q (Q>10) and low-Q (Q=3) measurements.

a. Set the 71E RANGE switch to 100 pF.

b. Set the function switch to CAL 1 ( high Q).

c. The digital readout should be 100.00, ± 0.03, pF. If the readout is not within tolerance, adjust the CAL 1 control.

d. Set the function switch to CAL 2 ( low Q).

e. The digital readout should be 100.00, ± 0.03, pF. If the readout is not within tolerance, adjust the CAL 2 control. If the CAL 2 control is out of range, set it at middle range and adjust the COARSE CAL 2 control on the rear panel of the 71E until proper ranging is restored.

f. Turn the function switch back to CAL 1 and check that the readout still is 100.00, ± 0.03,pF. If the readout is not within tolerance repeat steps c through f.

g. If the CAL 1 or CAL 2 control was adjusted in steps c or e, above, repeat step f in paragraph 3.4, through step h; and then repeat steps a through f, above, until all readings are within tolerance.

3.6 INDUCTANCE CALIBRATION.

a. Connect a short length of No. 22 AWG copper wire between the INDUCTANCE HI and GND terminals on the 71E. The wire should be taut between the two terminals.

b. Set the RANGE switch to 1μH and check for a readout of .0090, ± 0.0003, μH. If the readout is not within tolerance, adjust L101.

c. Remove the wire from the INDUCTANCE terminals and set the RANGE switch to 10 pF.

d. Set the function switch to OPERATE.

3.7 CAPACITANCE CALIBRATION WITH EXTERNAL STANDARDS. If required, the capacitance-measuring circuits in the 700C may be calibrated at check points other than 100 pF by using high-Q, 1 MHz, three-terminal capacitance standards, such as the Boonton Electronics Model CS-series. The use of low-Q capacitance standards is not recommended; the procedure in paragraph 3.5 provides adequate calibration for low-Q measurements.

a. Connect the high-Q ,1 MHz capacitance standard to the 71E CAPACITANCE TEST HI and LO terminals. The connecting cables should be as short as possible (not more than 3 to 4 inches) for capacitance values >100 pF.

b. Set the RANGE switch to a $C_{pF}$ position consistent with the value of the capacitance standard.

c. Peak the COMP adj control for a maximum readout on the digital display.

d. Disconnect the CAPACITANCE TEST LO cable from the capacitance standard.

e. Adjust the C ZERO control until the digital display reads 0.000, ± 3 on the last digit.

f. Connect the CAPACITANCE TEST LO cable to the capacitance standard and read the value on the digital display.

g. The readout should agree with the value and tolerance of the capacitance standard.

h. If necessary, adjust the CAL 1 control until the readout and the capacitance standard values are in agreement. However, if the CAL 1 control is adjusted, repeat steps f through h in paragraph 3.4, and steps a through g, above, until all readings are within tolerance.

i. Remove the external capacitance standard.

## PART 2. CAPACITANCE MEASUREMENTS

3.8 GENERAL. Be sure that the pre-operational adjustments are completed before attempting any measurements described in this section. Capacitance specimens can be measured either locally or remotely. The measurement is local when the specimen is connected directly at the CAPACITANCE TEST HI and LO terminals with the BNC-to-binding-post adapters or a test jig connected directly to the adapters. Perform local measurements in accordance with the procedure in paragraph 3.10. The measurement is remote when the test jig is cable-connected to the 700C. For remote measurements, observe the instructions in paragraph 3.9 before performing measurements ( par. 3.10), and correct for cable inductance in accordance with paragraph 3.11. Observe the applicable instructions in paragraph 3.12 through 3.14.

3.9 REMOTE MEASUREMENT CONSIDERATIONS. Use RG-62/U or similar low-capacitance coaxial cables to connect the remote test jig to the 700C. The length of the cable pair should not exceed five feet for measurements on the 10 pF range, and shorter lengths should be used on the higher capacitance ranges. Refer to Figure 3 for cable inductance correction information that may be used as a guide in selecting practical cable lengths. If capacitance specimens are to be measured on the 10 pF range, follow the procedure below before making any measurements.

a. Check that the test jig is connected to the CAPACITANCE TEST HI and LO terminals and the RANGE switch is at 10 pF.

b. Connect a typical test specimen to the test jig terminals.

c. Peak the COMP adj control for a maximum readout on the digital display.

d. Remove the test specimen from the test jig.

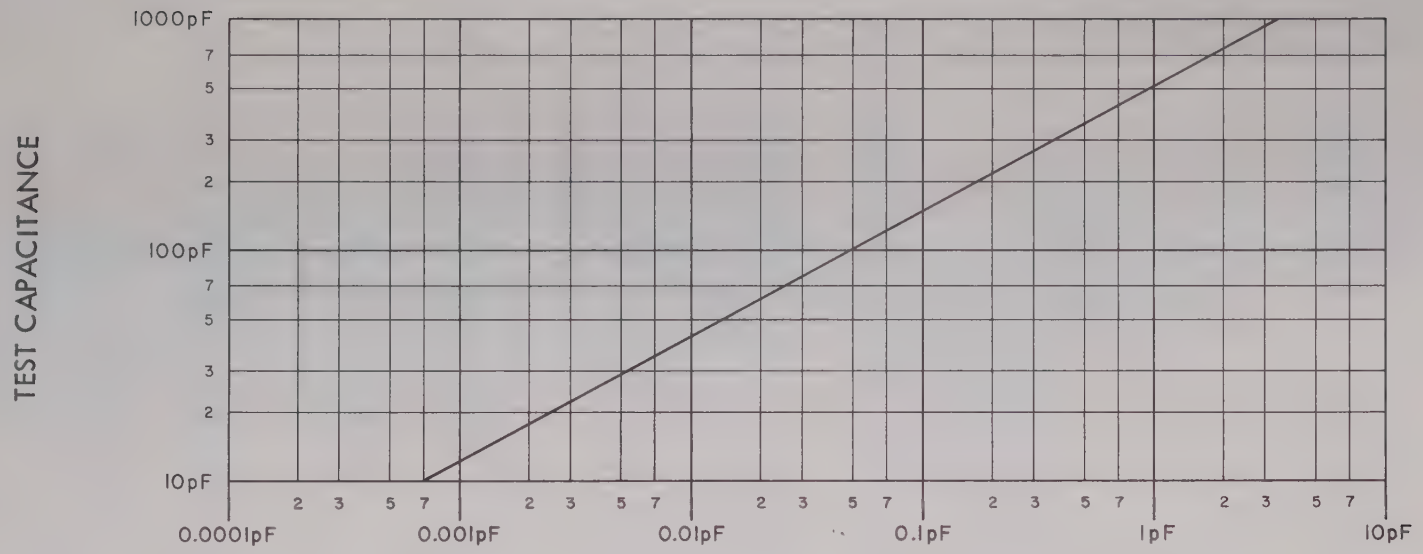
e. If necessary, adjust the C ZERO control for a readout of 0.000, ± 0.003, pF.

3.10 MEASURING CAPACITANCE SPECIMENS.

a. Set the 71E RANGE switch to a C pF position consistent with the test specimen value.

b. Connect the test specimen to the CAPACITANCE TEST HI and LO terminals or to the terminals of any connecting adapters or test jig.

c. Read the value of the test specimen on the digital display.




SUBTRACT pF FROM CAPACITANCE READING FOR EACH FOOT OF RG-62/U CONNECTING CABLE

NOTES

1. The two cables need not be of the same length. RG-58/U may also be used.
2. Correction for cables of other lengths may be computed as a simple ratio to one foot.
3. Both ends of the cable shields should be well grounded.

(When frequent remote measurements must be made, the Model 71-6B Capacitance Test Terminal Extender eliminates the necessity of making the above corrections).

Figure 3. Correction for Error in Capacitance Measurement Owing to Series Inductance Of RG-62/U Connecting Cables Having Combined Length of 1 Foot.

3.11 CORRECTING FOR CABLE INDUCTANCE. When a test specimen is remotely connected to the 700C, the series inductance of the connecting cables and the inductance of the specimen can cause measurement error. The measured value ($C_m$) of the test specimen will read higher than the true capacitance ($C_t$) in accordance with the following expression:

$$C_m = \frac{C_t}{1-\omega^2 LC_t} = \frac{C_t}{1-(X_L/X_{C_t})} \quad \text{or} \quad C_t = \frac{C_m}{1+(X_L/X_{C_t})}$$

Where,

L = the combined series inductance in μH of both lengths of connecting cables and the inductance of the test specimen (generally small compared to cable inductance).

Figure 3 indicates the correction to be made per foot of an RG-62/U pair for measured values ranging from 10 pF to 1000 pF.

3.12 EXTENDING THE C ZERO RANGE. The C ZERO control can balance-out up to 7 pF between either the CAPACITANCE TEST HI and LO terminals or the CAPACITANCE DIFF HI and LO terminals. Occasionally, an external jig assembly may contribute more than 7 pF capacitance and render the C ZERO control ineffective. When required, the range of the C ZERO control can be extended to approximately 30 pF by connecting a high-quality mica capacitor to the CAPACITANCE DIFF HI and LO terminals. Ideally, the value of the mica capacitor should approximate the estimated capacitance contributed by the external fixture.

3.13 DIFFERENTIAL MEASUREMENTS. Use the following procedure to determine the capacitance differential between two specimens. The specimens may be biased ( paragraph 3.14) or unbiased, and they can be connected either locally or remotely.

a. Connect the larger value specimen (if known) to the CAPACITANCE TEST HI and LO terminals.

b. Connect the other specimen to the CAPACITANCE DIFF HI and LO terminals.

c. Set the RANGE switch to a position consistent with the value of one of the specimens. If increased resolution is desired, set the RANGE switch to the next lower position, provided the overrange tolerance is not exceeded.

d. Read the capacitance differential directly on the digital display. If a negative readout results, the larger capacitance value is at the CAPACITANCE DIFF terminals, and the two specimens should be interchanged.

3.14 APPLYING DC BIAS. Follow the applicable procedure, below, to bias capacitance specimens that are to be measured on the 700C. In paragraph a, specimens are biased up to ± 140 volts by the internal bias supply. Use the procedure in paragraph b to apply bias from an external source up to ± 200 volts at 250 mA. Paragraph c contains instructions for applying external bias in excess of ± 200 volts. In all cases the bias voltage appears across both the CAPACITANCE TEST and DIFF terminals, and the BIAS fuse protects internal circuits for both internal and external bias applications.

a. Applying up to ± 140 volts.

(1) Set the polarity switch on the 94B to the required polarity. The polarity selected is applied to the CAPACITANCE TEST and DIFF HI terminals.

(2) Set the Display switch to V.

(3) Set the voltage range switch to the applicable position.

(4) Adjust the appropriate level control until the digital display indicates the required voltage level.

(5) Connect test specimens to the CAPACITANCE TEST or DIFF terminals, as required.

b. Applying Bias up to ± 200 volts.

(1) Set the Mode switch to EXT and perform steps a (2) and (3), above.

(2) Connect the output leads of the bias source to the 71E BIAS binding posts, observing the polarity and ground assignments.

(3) Adjust the external bias source to the required voltage level. Do not apply more than 200 volts at 250 mA or the BIAS FUSE may open. The digital display will readout bias up to 140 V (100 V+ 40% overrange).

(4) Connect test specimens to the CAPACITANCE TEST or DIFF terminals, as required.

c. Applying More Than +200 Volts Bias. When biasing requirements exceed ±200 volts, use the circuit in Figure 4 to connect the external bias source to the 700C. Notice that a shorting strap is connected across the 71E BIAS binding posts.

(1) Set the polarity switch to OFF (EXT BIAS).

(2) Adjust the external bias source to the required voltage level.

(3) Connect the biasing circuit (Figure 4) to the HI and LO terminals at either CAPACITANCE TEST or CAPACITANCE DIFF, as convenient.

(4) Connect test specimens in accordance with Figure 4.

Figure 4. Connections For External Bias ( Over 200 Volts)

## PART 3. INDUCTANCE MEASUREMENTS

3.15 MEASUREMENTS. After the pre-operational adjustments (paragraph 3.4) are completed, inductance measurements may be made in accordance with the procedure given below. When no specimen is connected to the 700C and the RANGE switch is set to a $L_{\mu H}$ position, a digital display blank-out and an OVERRANGE indication will result. However, the digital display will give a normal readout when an inductance specimen is connected to the 700C.

a. Connect a two-terminal inductance specimen directly to the 71E INDUCTANCE HI and GND terminals.

b. Set the RANGE switch to a $L_{\mu H}$ position consistent with the value of the test specimen.

c. Read the value of the test specimen on the digital display.

3.16 REMOTE MEASUREMENT CONSIDERATIONS. The 700C will accurately measure inductance values if test specimens are connected directly to the 71E INDUCTANCE HI and GND terminals. However, when a specimen is connected remotely, the connecting leads introduce inductance and capacitance to the measurement; under these conditions, there will be a small error in the result. A typical example of the error percentage found in remote measurement is shown in Figure 5.

NOTE: The error in remote inductance measurement can be eliminated to a large extent by using the Model 71-7A Inductance Test Terminal Extender.

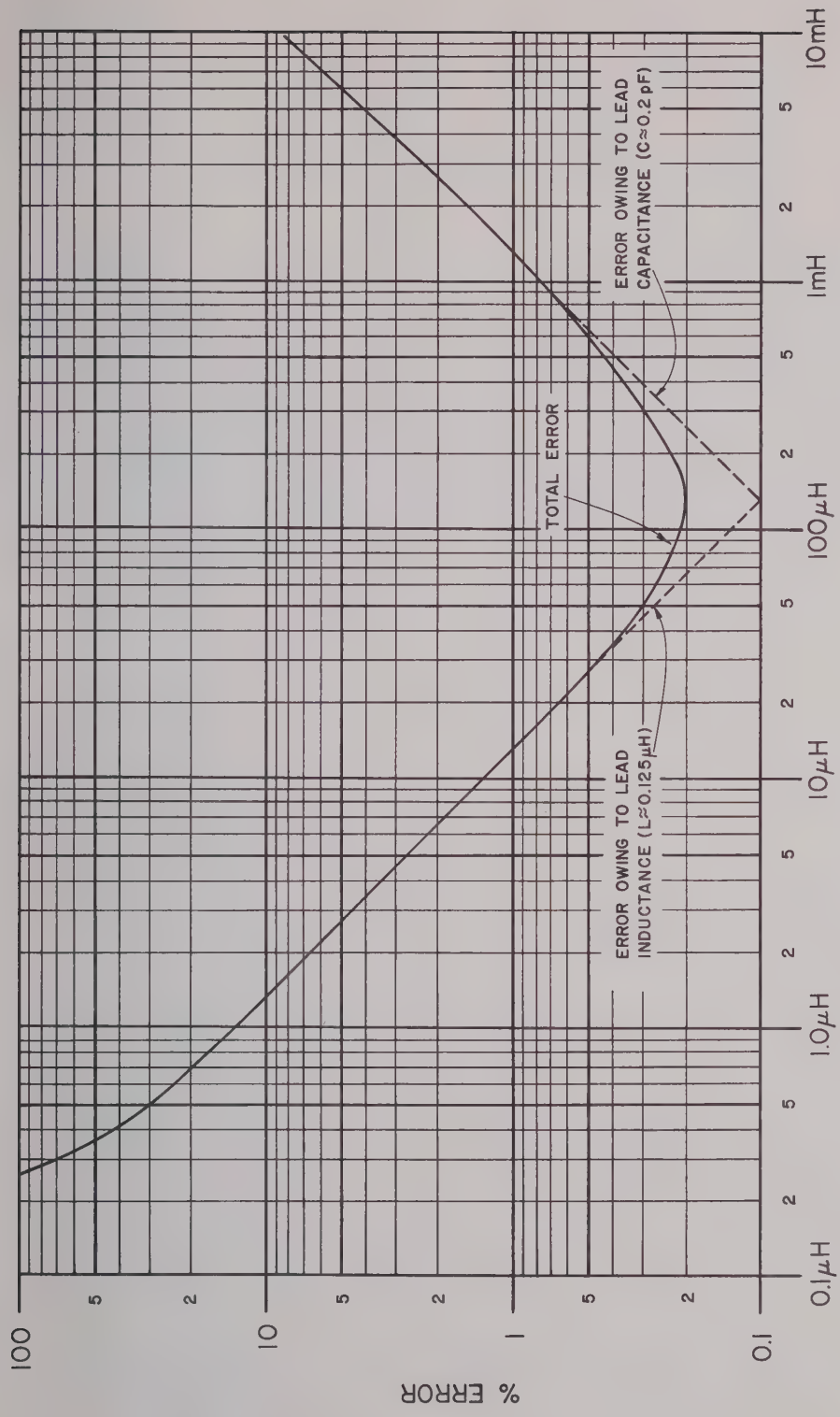



Figure 5. Connection Error Resulting From 3 inch Leads of No. 20 Wire Spaced 3/4 inches Apart.

## PART IV. SYSTEM APPLICATIONS

3.17 GENERAL. A BCD output permits the 700C to be used in system applications, as described in paragraph 1.1. When the 700C is an integral part of a system configuration, it may be remotely controlled and triggered manually, or it can be triggered automatically in synchronism with some system event. Provision also is made to apply a code-inhibit input signal to the 700C, if required. This signal can be used to inhibit a conversion process and can eliminate the need for buffer storage. In a typical application, the code-inhibit input signal can be used to momentarily stop the 700C readout until a slower unit, such as a printer or card punch, records data. For system or external requirements, all input and output connections on the 700C are made at the receptacle located on the rear panel of the 94B unit. See Figure 6, below, for receptacle connections. See Table 4 for full identification of the terminals.

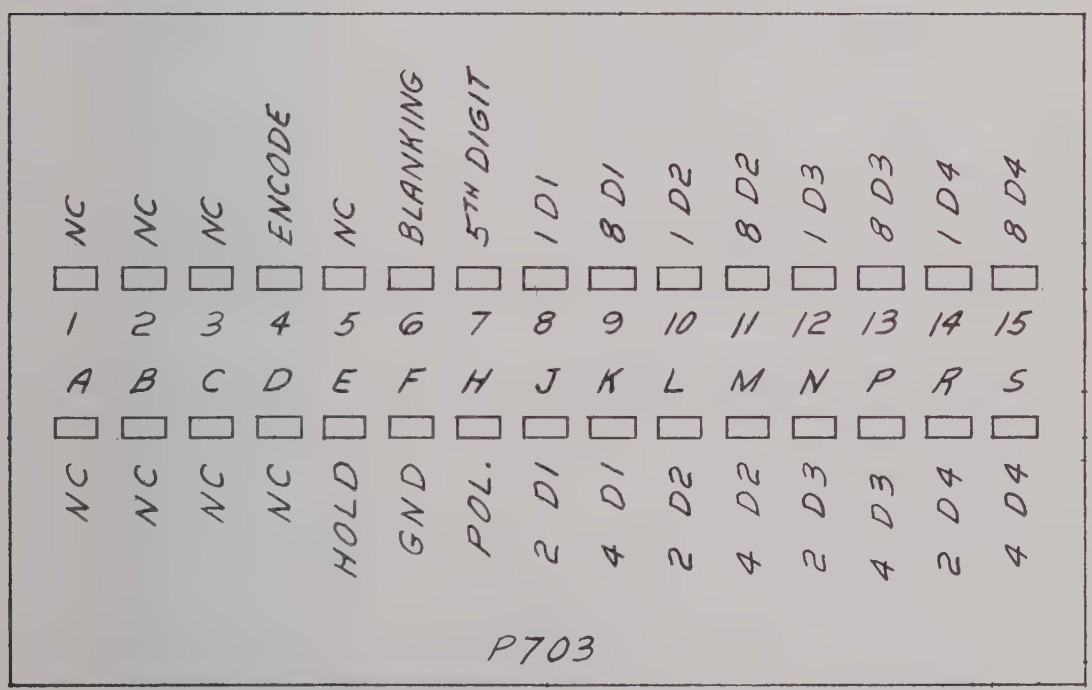

NC NC NC ENCODE NC BLANKING 5TH DIGIT 1 D1 8 D1 1 D2 8 D2 1 D3 8 D3 1 D4 8 D4
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
A B C D E F H J K L M N P R S
NC NC NC NC HOLD GND POL. 2 D1 4 D1 2 D2 4 D2 2 D3 4 D3 2 D4 4 D4
P703

Figure 6. External Connections

TABLE 4

| TERMINAL | | REMARKS |
|---|---|---|
| 4 | ENCODE output: | Logic 1 = Encode in progress<br>Logic 0 = End of encode |
| E | HOLD input: | Logic 0 inhibits encode<br>Logic 1 or open circuit enables encode |
| F | GROUND | |
| 6 | BLANKING output: | Logic 0 = Display blanked<br>Logic 1 = Display on |
| H | POLARITY output: | Logic 1 = +<br>Logic 0 = - |
| 7 | 5TH DIGIT output: | Logic 0 = 5th digit on<br>Logic 1 = 5th digit off |
| 8 | Bit 1 | BCD outputs for digit 1 (least significant digit) |
| J | Bit 2 | Logic 1 = Bit on |
| K | Bit 4 | Logic 0 = Bit off |
| 9 | Bit 8 | |
| 10 | Bit 1 | |
| L | Bit 2 | Digit 2 BCD outputs |
| M | Bit 4 | |
| 11 | Bit 8 | |
| 12 | Bit 1 | |
| N | Bit 2 | Digit 3 BCD outputs |
| P | Bit 4 | |
| 13 | Bit 8 | |
| 14 | Bit 1 | |
| R | Bit 2 | Digit 4 BCD outputs |
| S | Bit 4 | (most significant digit) |
| 15 | Bit 8 | |

Logic 1: $V_o \geq +3.4$ volts

$Z_o \cong 150$ ohms

Logic 0: $V_o \leq +0.5$ volts

$Z_o \cong 75$ ohms

Maximum sink current at Logic 0 = 1.6 mA.
( 1 std. TTL load)

# CHAPTER IV

# THEORY OF OPERATION

4.1 DIGITAL DISPLAY UNIT. Basically, the 94B Digital Display Unit converts the dc analog output of the 71E Capacitance/Inductance Reference Unit to digital form. These digital signals are then used to trigger the cathodes of the appropriate Nixie display tubes.

The major circuit blocks of the 94B are the start generator, the operational amplifier circuits, the analog switch circuits, the reference voltage circuits, the polarity and shutdown logic circuits, and the storage and display circuits. In the discussion that follows, reference is made to circuit symbols appearing in the Schematic drawings found at the back of this book.

4.1.1 Start Generator Circuit. Q18 switches at 60 Hz because of the alternating current flowing through R9. The negative-going edge of this square wave is coupled to B2 of Q19. The trigger voltage of Q19 is therefore lowered every 1/60 second for a short time. C30 charges through R76 until the lower trigger voltage points is reached; a short positive pulse then appears of R79 and IC18-2. As long as IC18-1 is open, IC18-3 goes to ground. This is inverted in IC18-4 to IC18-6, and appears as a positive-going pulse on the base of Q20. Q20 saturates for approximately 2 microseconds. This provides the reset and start pulses. C30 recharges and the cycle repeats about every 200 milliseconds.

4.1.2 Operational Amplifier Circuit. The operational amplifier A1 is an amplifier with a closed loop gain of 5, with low drift characteristics. C12 and C15 determine the step response of the operational omplifier. CR11 and CR12 protect the amplifier from high voltage inputs.

4.1.3 Analog Switches. There are four analog switch circuits which use N channel depletion type FET's with low resistance. Q21, R81, R82, and R83 comprise a level shifter. A positive voltage of the input of R81 turns off Q21 and the associated FET. A ground on the input allows R82 to bias Q21 on, turning the FET into its on state.

4.1.4 Reference Voltages. The temperature-compensated voltage across CR15 is divided by R64, R68 and R70. R68 adjusts the voltage applied to R69 and provides a positive reference current. R65, R66 and IC21 comprise a voltage inverter to provide the negative reference voltage. R68 and R72 are adjustable potentiometers used for full scale calibration.

4.1.5 Polarity and Shutdown Logic. R54 and CR16 provide level shifting between the ±15 volt output of IC14 and the 0 to +5 volt input of the gates. IC19-1 and IC19-2 inhibit shutdown during the first 10,000 counts. IC19-3 and IC19-4 inhibit the switches after shutdown. Operation for a positive input is as follows: IC17-2 and IC19-13 are at logic 0, and IC19-12 is at logic 1. IC17-13 and IC17-4, together with IC18-9 go to a logic 1 after 10,000 counts (when IC19-1 goes to 0). IC18-8 goes to logic 0, setting the polarity flip-flop (IC15-6, IC15-9, IC15-8, IC15-5). IC17-1 goes to logic 0, keeping IC17-12 at logic 1. Q19 turns on due to the logic 0 on IC18-8. As the integrator passes through zero, IC17-2 and IC18-13 go to a logic 1. IC19-12 goes to a logic 0, IC18-8 goes to a logic 1. IC17-6 now goes to a logic 0 and sets the flip-flop consisting of IC15-1, IC15-11, IC15-3 and IC15-12. This shuts down the oscillator and drives IC18-11 to zero, transferring the counter outputs into the storage register. IC19-4 drives IC17-4, IC17=13 and IC18-9 to zero, turning off Q23 and Q16.

Operation for a negative input is as follows: IC17-2 and IC19-13 are at logic 1. IC17-4, IC17-13 and IC18-9 go to a logic 1 at 10,000 counts. IC17-12 goes to 0, turning on Q17. IC18-8 remains at a 1 due to the zero on pin 10. As the ramp passes through zero, IC17-2 and IC19-13 go to a logic 0. IC17-12 goes to a 1 before C25 can charge. IC17-6 goes to a 0 and sets the shutdown flip-flop. From this point on, operation is the same as in the positive input case.

4.1.6 Storage and Display Circuits. IC1, IC2, IC3 and IC4 are decade counters used to provide 1 - 2 - 4 - 8 BCD outputs. Each counter is reset by a logic 1, and a reset width of at least 1 microsecond is required to insure that all four counters are reset.

IC5 is a quad latch. When pin 4 and pin 13 are at logic 1, the information present

on the input pins is transferred into storage; it remains in storage as long as pins 4 and 13 are at logic 0.

When the output pins of IC9 go low, the BCD-to-decimal driver lights the associated Nixie cathode.

The storage transfer line is normally low during operation. The counters are reset and then count. When the encode has been completed the line labelled "XFER IN" goes low and the XFER line is driven high for about 3 microseconds. Counter outputs are transferred to the storage flip-flops in IC5 and to the decoder-Nixie driver inputs. When the XFER line goes low again, IC5 is used to store the BCD information until the next pulse.

4.2 C/L REFERENCE UNIT. The capacitance measuring network of the 71E unit is basically a series circuit in which the current is sensibly proportional to the susceptance of the capacitor being tested. This is achieved by using a low-impedance test voltage generator whose level is tightly controlled at a level of approximately 15 millivolts, and a calibrated detector whose input conductance is large relative to the susceptance of the test capacitor.

The quadrature relationship of the test capacitor and the detector is helpful in providing an output indication that is a linear function of capacitance. To improve the linearity further, and to suppress the influence of the test capacitor's loss, the detector is phase-sensitive to the susceptance of the test specimen only. The linearity achieved is better than 0.1% of the value. Range switching is done by changing the input conductance of the detector.

The instrument measures the direct capacitance or the three-terminal capacitance of specimens. Stray capacitance to ground appearing across the generator does not affect the reading, owing to the negligible impedance of the generator. Capacitance across the detector input has little effect on the measurement except for the three lowest ranges. On these ranges, however, a parallel-resonant circuit can be adjusted to absorb the shunt capacitance to ground across the detector.

The inductance measuring network of the 71E is the dual of the capacitance network; a constant current is passed through the test specimen and the detector senses the resultant voltage across the specimen.

The block diagram below (Figure 7) shows the basic configuration of the 700C in simplified form.

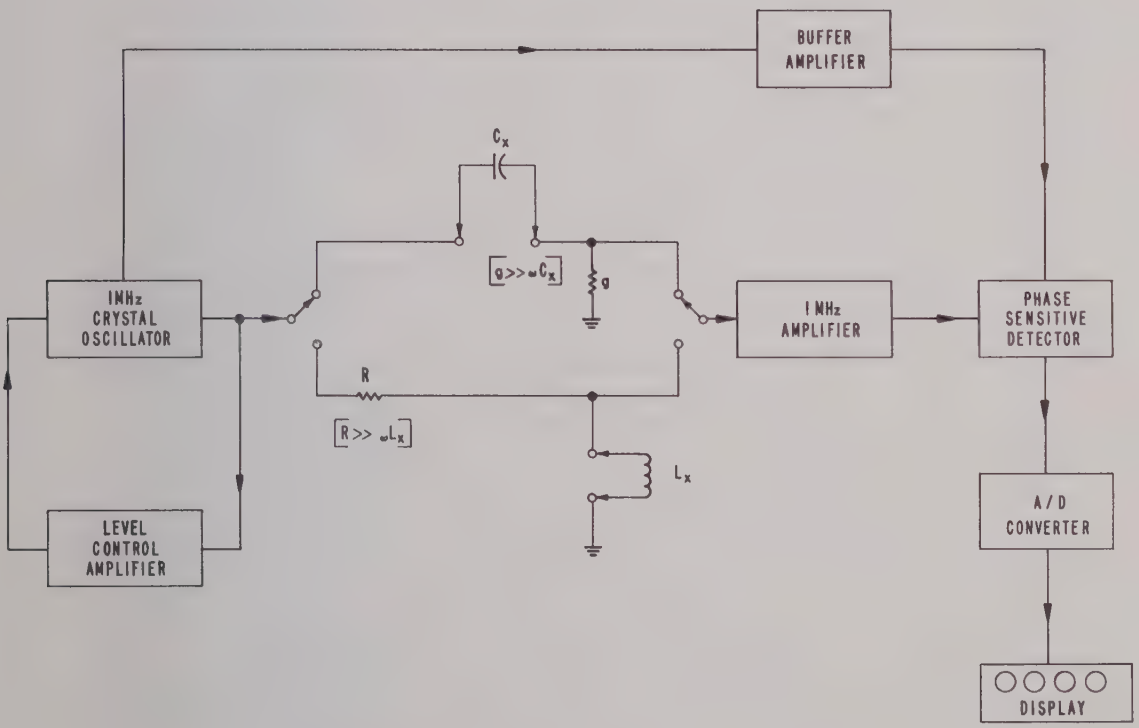



Figure 7. Block Diagram, 700C

TABLE OF REPLACEABLE PARTS
DIGITAL VOLTMETER

NOTE: The Digital Voltmeter is a purchased assembly. In the Table below, BEC Part Numbers have not yet been assigned to the individual components listed. In the event that a component requires replacement, please call Boonton Electronics.

| Reference | Description | | Part Number |
|---|---|---|---|
| R1 | Resistor | 1.5K 1/4 W | RC07 |
| R2 | " | 1.0K 1/4 W | " |
| R3 | " | 2.7K 1/4 W | " |
| R4 | " | 4.99K 1% | RN60D |
| R5 | " | 3.48K 1% | RN60D |
| R6 | " | 3.3K 1/4 W | RC07 |
| R7 | " | 7.15K 1% | RN60D |
| R8 | " | 7.5K 1% | RN60D |
| R9 | " | 10K 1/4 W | RC07 |
| R10 | " | 470Ω 1/4 W | " |
| R11 | " | 3.9K 1/4 W | " |
| R12 | " | 33K 1/4 W | " |
| R13 | " | 68K 2 W | 2W |
| R14 | " | 47K 1/4 W | RC07 |
| R15 | " | 3.3K 1/4 W | " |
| R16 | " | 1K 1/4 W | " |
| R17 | " | 4.7K 1/4 W | " |
| R18 | " | 33K 1/4 W | " |
| R19 | " | 100K 1/4 W | " |
| R20 | " | 1K 1/4 W | " |
| R21 | " | 4.7K 1/4 W | " |
| R22 | " | 33K 1/4 W | " |
| R23 | " | 68K 1/2 W | RC20 |
| R24 | " | 1K 1/4 W | RC07 |
| R25 | " | 4.7K 1/4 W | " |
| R26 | " | 1K 1/4 W | " |
| R27 | " | 4.7K 1/4 W | " |



700C
-470

| Reference | | Description | Part Number |
|---|---|---|---|
| R28 | Resistor | 33K 1/4 W | RC07 |
| R29 | " | 68K 1/2 W | RC20 |
| R30 | " | 18K 1/2 W | " |
| R31 | " | 1MΩ 1/4 W | RC07 |
| R32 | " | 18K 1/2 W | RC20 |
| R33 | " | 1MΩ 1/4 W | RC07 |
| R34 | " | 18K 1/2 W | RC20 |
| R35 | " | 1MΩ 1/4 W | RC07 |
| R36 | " | 18K 1/2 W | RC20 |
| R37 | " | 1MΩ 1/4 W | RC07 |
| R38 | | 1MΩ 1% | RN65E |
| R39 | " | 825K 1% | " |
| R40 | " | 1.5K 1/4 W | RC07 |
| R41 | " | 5MΩ 1% | PME65T9 |
| R42 | " | 47Ω 1/4 W | RC07 |
| R43 | " | 49.9K 1% | RN60E |
| R44 | | | |
| R45 | Potentiometer | 100K | 79PR |
| R46 | Resistor | 5MΩ 1% | PME65T9 |
| R47 | " | 49.9K 1% | RN60D |
| R48 | " | 1.5K 1/4 W | RC07 |
| R49 | " | 47Ω 1/4 W | " |
| R50 | " | 1.10K 1% | RN60D |
| R51 | " | 1.10K 1% | " |
| R52 | " | 249K 1% | " |
| R53 | " | 100Ω 1% | " |
| R54 | " | 3.9K 1/4 W | RC07 |
| R55 | " | 330Ω 1/4 W | " |
| R56 | " | 1K 1/4 W | " |
| R57 | " | 1K 1/4 W | " |
| R58 | " | 1K 1/4 W | " |
| R59 | " | 1K 1/4 W | " |
| R60 | " | 1K 1/4 W | " |
| R61 | " | 2.2 - 2.7K 1/4 W (selected) | " |
| R62 | " | 1K 1/4 W (selected) | " |

| Reference | | Description | Part Number |
|---|---|---|---|
| R63 | Resistor | 1.10K 1% (selected) | RN60D |
| R64 | " | 1.00K 1% (selected) | RN60E |
| R65 | " | 15K 1% | " |
| R66 | " | 15K 1% | " |
| R67 | " | 7.5K 1% | RN60D |
| R68 | Potentiometer | 200Ω | 41 |
| R69 | Resistor | 49.9K 1% | RN60E |
| R70 | " | 4.99K 1% | " |
| R71 | " | 4.99K 1% | " |
| R72 | Potentiometer | 200Ω | 41 |
| R73 | Resistor | 49.9K 1% | RN60E |
| R74 | " | 1.0K 1% (selected) | " |
| R75 | " | 22K 1/4 W | RC07 |
| R76 | " | 300K 1/4 W (selected) | " |
| R77 | " | 1K 1/4 W | " |
| R78 | " | 4.7K 1/4 W | " |
| R79 | " | 270Ω 1/4 W | " |
| R80 | " | 4.7K 1/4 W | " |
| R81 | " | 10K 1/4 W | " |
| R82 | " | 56K 1/4 W | " |
| R83 | " | 100K 1/4 W | " |
| R84 | " | 10K 1/4 W | " |
| R85 | " | 56K 1/4 W | " |
| R86 | " | 100K 1/4 W | " |
| R87 | " | 10K 1/4 W | " |
| R88 | " | 56K 1/4 W | " |
| R89 | " | 100K 1/4 W | " |
| R90 | " | 10K 1/4 W | " |
| R91 | " | 56K 1/4 W | " |
| R92 | " | 100K 1/4 W | " |
| R93 | " | 1K 1/4 W | " |
| R94 | " | 4.7K 1/4 W | " |
| R95 | " | 4.7K 1/4 W | " |
| R96 | " | 33K 1/4 W | " |

| Reference | Description | | Part Number | |
|---|---|---|---|---|
| C1 | Capacitor, | 4 µF 250V Elect. | C-D | BR4-250 |
| C2 | " | 250 µF 25V Elect. | Sprague | TVA-1208 |
| C3 | " | 50 µF 25V Elect. | Amp. | C426AR-F50 |
| C4 | | | | |
| C5 | " | 250 µF 25V Elect. | Sprague | TVA-1208 |
| C6 | | | | |
| C7 | " | 1600 µF 10V Elect. | Amp. | C437AR-D1600 |
| C8 | " | 330 pF 1 kV Disc | Centr. | DD331 |
| C9 | | | | |
| C10 | | | | |
| C11 | " | 2000 pF 1 kV Disc | Centr. | DD202 |
| C12 | " | 1000 pF Mica | Elm. | DM20-102J |
| C13 | " | 5000 pF 50V Disc | Centr. | CK502 |
| C14 | " | 200 pF 1 kV Disc | Centr. | DD201 |
| C15 | " | 1000 pF Mica | Elm. | DM20-102J |
| C16 | " | 1 µF 50 V Mylar | Sprague | 431P1059R5 |
| C17 | " | 22 pF 1 kV Disc | Centr. | DD220 |
| C18 | " | 1000 pF 1 kV Disc | Centr. | DD103 |
| C19 | " | 1000 pF 1 kV Disc | Centr. | DD103 |
| C20 | " | .025 µF 50V Disc | Centr. | CK253 |
| C21 | " | 0.68 µF 35V Tant. | Sprague | 196D684X0035DB |
| C22 | " | 0.68 µF 35V Tant. | Sprague | 196D684X0035DB |
| C23 | " | 3.3 pF 1 kV Disc | Centr. | DD3R3 |
| C24 | " | 470 pF 1 kV Disc | Centr. | DD471 |
| C25 | " | 330 pF 1 kV Disc | Centr. | DD331 |
| C26 | " | .01 µF 100V Mylar | Elm. | 1DP-1-103 |
| C27 | " | 1000 pF 1 kV Disc | Centr. | DD102 |
| C28 | " | 5000 pF 50V Disc | Centr. | CK502 |
| C29 | " | 15 pF 1 kV Disc | Centr. | DD150 |
| C30 | " | 1 µF 35V Tant. | Sprague | 196D105X0035DB |

| Reference | Description | | Part Number |
|---|---|---|---|
| A1 | Amplifier, Integrated Operational | 801A | Analog Devices |
| 1C1 | Decade Counter | SN7490N | T.I. |
| 1C2 | " " | " | " |
| 1C3 | " " | " | " |
| 1C4 | " " | " | " |
| 1C5 | Latch, Integrated Quad | N7475B | Signetics |
| 1C6 | " " " | " | " |
| 1C7 | " " " | " | " |
| 1C8 | " " " | " | " |
| 1C9 | Decoder, BCD to DEC | N7441B | " |
| 1C10 | " " | " | " |
| 1C11 | " " | " | " |
| 1C12 | " " | " | " |
| 1C13 | Latch, Integrated Quad | N7475B | " |
| 1C14 | Dual Amplifier | MC1437L | Motorola |
| 1C15 | 2-input Quad Gate | MC846P | " |
| 1C16 | " " | " | " |
| 1C17 | 3-input Gate | MC862P | " |
| 1C18 | 2-input Quad Gate | MC846P | " |
| 1C19 | Hex Inverter | MC836P | " |
| 1C20 | J-K Flip-flop | MC845P | " |
| 1C21 | Operational Amplifier | U6E7741393 | Fairchild |
| | | | |
| CR1 | Diode, Silicon | 1N4004 | |
| CR2 | " " | 1N4001 | |
| CR3 | " " | " | |
| CR4 | " " | " | |
| CR5 | " " | " | |
| CR6 | Rectifier, Bridge | MDA920-A1 | Motorola |
| CR7 | " " | " | " |
| CR8 | " " | " | " |
| CR9 | " " | " | " |
| CR10 | Diode, Zener, 5.1V 5% | .4M5.1AZ | Motorola |

| Reference | Description | | Part Number |
|---|---|---|---|
| CR11 | Diode, Silicon | 1N457 | Motorola |
| CR12 | " " | " | " |
| CR13 | " " | " | " |
| CR14 | " " | " | " |
| CR15 | Diode, Zener | 1N829 | |
| CR16 | Diode, Silicon | 1N914 | |
| CR17 | " " | " | |
| | | | |
| Q1 | Transistor, Silicon NPN | 2N2219 | Motorola |
| Q2 | " " " | MPS-2924 | " |
| Q3 | " " PNP | 2N4037 | RCA |
| Q4 | " Darlington | D28C1 | GE |
| Q5 | " Silicon PNP | 2N4126 | Motorola |
| Q6 | " " NPN | MPS-2924 | " |
| Q7 | " " " | 2N3877A | GE |
| Q8 | " " " | " | " |
| Q9 | " " " | " | " |
| Q10 | " " " | MPS-2924 | Motorola |
| Q11 | " " " | TRS-2504 | Industro |
| Q12 | " " " | " | " |
| Q13 | Transistor, Field Effect | 2N4093 | |
| Q14 | | | |
| Q15 | " " | 2N5457 | Motorola |
| Q16 | " " | 2N4093 | |
| Q17 | " " | " | |
| Q18 | " Silicon NPN | MPS-2924 | Motorola |
| Q19 | Transistor, Unijunction | 2N4870 | " |
| Q20 | " Silicon, NPN | MPS-2924 | " |
| Q21 | " " PNP | 2N4126 | " |
| Q22 | " " " | " | " |
| Q23 | " " " | " | " |
| Q24 | " " " | " | " |
| Q25 | " " NPN | MPS-2924 | " |

TABLE OF REPLACEABLE PARTS
C/L REFERENCE UNIT 71E

| Reference | | Description | Mfr. | Part Number |
|---|---|---|---|---|
| R101 | Resistor | 47 KΩ 5% 1/2W | AB-EB | 301127 |
| R102 | " | 169 Ω 1% 1/4W | Corning NA60D | 315068 |
| R104 | " | 1.65KΩ 1% 1/4W | " | 315092 |
| R105 | | | | |
| R106 | " | 16.9KΩ 1% 1/4W | " | 315117 |
| R111 | " | 604Ω 1% 1/4W | " | 315082 |
| R113 | " | 60.4Ω 1% 1/4W | " | 315058 |
| R115 | " | 10Ω 1% 1/4W | " | 315039 |
| R116 | " | 13Ω 1% 1/4W | " | 315042 |
| R117 | " | 220KΩ 5% 1/2W | AB-EB | 301143 |
| R119 | " | 4.7KΩ 5% 1/2W | " | 301103 |
| R201 | " | 47Ω 5% 1/2W | AB-EB | 301055 |
| R202 | " | 510KΩ 5% 1/2W | " | 301152 |
| R203 | " | 1.5 kΩ 5% 1/2W | " | 301091 |
| R204 | " | 19.6 Ω 1% 1/4W | Corning NA60D | 315045 |
| R205 | " | 330KΩ 5% 1/2W | AB-EB | 301147 |
| R206 | " | 1 kΩ 5% 1/2W | AB-EB | 301087 |
| R207 | " | 12KΩ 5% 1/2W | " | 301113 |
| | | 13KΩ 5% 1/2W | " | 301114 |
| | | 15KΩ 5% 1/2W | " | 301115 |
| | | 18KΩ 5% 1/2W | " | 301117 |
| | | 20KΩ 5% 1/2W | " | 301118 |
| | | 22KΩ 5% 1/2W | " | 301119 |
| | | 24KΩ 5% 1/2W | " | 301120 |
| | | 27KΩ 5% 1/2W | " | 301121 |
| | | 30KΩ 5% 1/2W | " | 301122 |
| | | 33KΩ 5% 1/2W | " | 301123 |
| | | 36KΩ 5% 1/2W | " | 301124 |

| Reference | | Description | Mfr. | Part Number |
|---|---|---|---|---|
| R207 | Resistor | 39KΩ 5% 1/2W | AB-EB | 301125 |
| | " | 43KΩ 5% 1/2W | " | 301126 |
| | " | 47KΩ 5% 1/2W | " | 301127 |

NOTE: R207 is selected by the calibration department.

| | | | | |
|---|---|---|---|---|
| R208 | Resistor | 1.21KΩ 1% 1/4W | Corning NA60D | 315089 |
| R209 | " | 47Ω 5% 1/2W | AB-EB | 301055 |
| R210 | " | 510KΩ 5% 1/2W | " | 301152 |
| R211 | " | 1.5 kΩ 5% 1/2W | " | 301091 |
| R212 | " | 330KΩ 5% 1/2W | " | 301147 |
| R213 | " | 1 kΩ 5% 1/2W | " | 301087 |
| R214 | " | 47Ω 5% 1/2W | " | 301055 |
| R215 | " | 510KΩ 5% 1/2W | " | 301152 |
| R216 | " | 150Ω 1% 1/4W | Corning NA60D | 315067 |
| R217 | " | 909Ω 1% 1/4W | " AB-EB | 326103 |
| R218 | " | 100 kΩ 5% 1/2W | AB-EB | 301135 |
| R219 | " | 46.4Ω 1% 1/2W | IRC DC6 | 306079 |
| R220 | " | 470Ω 5% 1/2W | AB-EB | 301079 |
| R221 | " | 169Ω 1% 1/4W | Corning NA60D | 315068 |
| R222 | " | 46.4Ω 1% 1/4W | | 306079 |
| R223 | " | " " | | " |
| R301 | " | 2KΩ 5% 1/2W | AB-EB | 301094 |
| R302 | " | 470Ω 5% 1/2W | " | 301079 |
| R303 | " | 6.8KΩ 5% 1/2W | Corning C-5 | 315012 |
| R304 | Potentiometer | 1KΩ ±10% | AB JA2N200P102UE | 311111 |
| R305 | Resistor | 6.8KΩ 5% 1/2W | Corning C-5 | 315012 |
| R306 | " | 100Ω 1% 1/4W | Corning NA60D | 326031 |
| R307 | " | " | " | " |

| | | | | |
|---|---|---|---|---|
| R401 | Resistor | 68KΩ 5% 1/2W | AB-EB | 301131 |
| R402 | " | 180KΩ 5% 1/2W | " | 301141 |
| R403 | " | 110Ω 5% 1/2W | " | 301064 |
| R404 | " | 470Ω 5% 1/2W | " | 301079 |
| R405 | " | 33KΩ 5% 1W | AB-GB | 302137 |

| Reference | | Description | Mfr. | Part Number |
|---|---|---|---|---|
| R406 | Resistor | 33KΩ 5% 1W | AB- GB | 302137 |
| R407 | Potentiometer | 10KΩ ±5% Lin. ±0.25% | Bourns 3509S-18-RC 10 Turns | 311260 |
| R408 | Resistor | 43KΩ 5% 1/2W | Corning C-5 | 315005 |
| R409 | " | 160KΩ 5% 1/2W | " C-20 | 315440 |
| R410 | " | " | " | 315440 |
| R411 | " | 6.8KΩ 5% 1/2W | Corning C-5 | 315012 |
| R412 | | | | |
| R413 | " | 20KΩ 5% 1/2W | AB-EB | 301118 |
| R414 | " | 100Ω 1% 1/2W | T.I. MC60D | 326031 |
| R415 | Potentiometer | 3KΩ 20% | IRC 34-1610-7827 | 311112 |
| R416 | Resistor | 20KΩ 5% 1/2W | AB-EB | 301118 |
| R417 | " | 100Ω 1% 1/2W | T.I. MC60D | 326031 |
| R418 | " | 1MΩ 5% 1/2W | AB-EB | 301159 |
| R419 | " | 33KΩ 5% 1/2W | " | 301123 |
| R420 | " | 130KΩ 5% 1/2W | " | 301138 |
| R421 | " | 2.7KΩ 5% 1/2W | " | 301097 |
| R422 | " | 2.2MΩ 5% 1/2W | " | 301167 |
| R423 | " | 51KΩ 5% 1/2W | " | 301128 |
| R424 | " | 20KΩ 5% 1/2W | " | 301118 |
| R425 | " | 100Ω 1% 1/2W | T.I. MC60D | 326031 |
| R426 | " | " | " | " |
| R427 | " | 20KΩ 5% 1/2W | AB-EB | 301118 |
| R428 | " | 2.2MΩ 5% 1/2W | " | 301167 |
| | | | | |
| R501 | Potentiometer | 5KΩ ±20% | CTS 34-5204 Type Q | 311101 |
| R502 | " | " | " | " |
| R503 | " | " | " | " |
| R504 | " | " | " | " |
| R505 | " | " | " | " |
| R506 | " | " | " | " |
| R507 | Resistor | 4.99KΩ 1% 1/4W | Corning NA60D | 315103 |
| R508 | " | 10KΩ 1% 1/2W | Corning NA65D | 315411 |

| Reference | | Description | Mfr. | Part Number |
|---|---|---|---|---|
| R601 | Resistor | 20KΩ 5% 1/2W | AB-EB | 301118 |
| R602 | Potentiometer | 250KΩ 20% | CTS 34-5203B Type Q | 311103 |
| R603 | Resistor | 2.2MΩ 5% 1/2W | AB-EB | 301167 |
| R604 | " | 1MΩ 5% 1/2W | " | 301159 |
| R605 | " | 4KΩ 5% 10W | Ohmite 1707 | 312119 |
| | | | | |
| C101 | Capacitor, Fixed | 0.068 µF 200F | Sprague 192P22492 | 234051 |
| C102 | " Var. | 8.7 pF/Sect. | Johnson 1604305 | 275138 |
| C103 | " Fixed | 120 pF 5% 500V | Arco DM-15F-121J | 200002 |
| C104 | " Var. | 50 pF | | 275139 |
| C105 | " " | 0.7 - 3 pF | Erie 535-008-4R | 279109 |
| C106 | " Fixed | 0.033 µF 200V | Sprague 192P33392 | 234045 |
| C107 | " Var. | 140 pF | Hamm. APC 140 | 275104 |
| C108 | " Fixed | 0.02 µF 500V | Erie 841Z5V203P | 224118 |
| C109 | " " | " | " | " |
| C110 | " " | 97 pF | | 200040 |
| C111 | " Var. | 0.7 - 3 pF | Erie 535-008-4R | 279109 |
| C112 | " " | " | " | " |
| C113 | " Fixed | 0.01 µF 200V | Sprague 192P10392 | 234027 |
| C114 | " " | 0.1 µF 200V | Sprague 192P10492 | 230116 |
| C115 | " " | 0.022 µF 200V | Sprague 192P22392 | 230101 |
| | | | | |
| C201 | Capacitor, Fixed | 0.001 µF 200V 10% | Sprague 192P10292 | 234039 |
| C202 | " " | 0.02 µF 500V | Erie 841Z5V20 | 224118 |
| C203 | " " | 0.1 µF 25V | Erie 5815-000-1042 | 224124 |
| C204 | " " | 0.02 µF 500V 20% | Erie 841Z5V203P | 224118 |
| C205 | " " | 75 pF 500 V | Arco DM15-750J | 200059 |
| C206 | " " | 0.02 µF 20% 500V | | 224118 |
| C207 | " " | 0.01 µF 10% 200V | | 234027 |
| C208 | " " | 0.1 µF 25V | Erie 5815-000-1042 | 224124 |
| C209 | " " | 0.02 µF 20% 500V | Erie 841Z5V203P | 224118 |
| C210 | " " | 75 pF 500 V | Arco DM15-750J | 200059 |
| C212 | " " | 0.01 µF 10% 200V | | 234027 |

| Reference | | Description | Mfr. | Part Number |
|---|---|---|---|---|
| C213 | Capacitor, Fixed | 560 pF 5% 300V | Arco DM15-561J | 200029 |
| C214 | " Var. | 7 - 45 pF | Erie 503-041-D2PO-24R | 275114 |
| C215 | " Fixed | 0.02 µF 20% 500V | Erie 841Z5V203P | 224118 |
| C216 | " " | 75 pF 500 V | Arco DM15-750J | 200059 |
| C217 | " " | 0.02 µF 500V | Erie 841Z5V203P | 224118 |
| C218 | " " | 470 pF 5% 300V | Arco DM15-471J | 200028 |
| | | | | |
| C301 | Capacitor, Fixed | 0.02 µF 20% 500V | Erie 841Z5V203P | 224118 |
| C302 | " " | " | " | " |
| C303 | " " | " | " | " |
| C304 | " " | 0.1 µF 10% 200V | Sprague 192P10492 | 230116 |
| C305 | " " | 430 pF 1% 500V | Arco DM15-431F | 200037 |
| C306 | " " | " | " | " |
| C307 | " " | 0.022 µF 20% 200V | Sprague 192P22302 | 230101 |
| C308 | " " | " | " | " |
| C309 | " " | 10 pF 500 V | Arco DM10C-100J | 200022 |
| C310 | " Var. | 5.5 - 18 pF | Erie 538-002-C0P0-92R | 281001 |
| C401 | Capacitor, Fixed | 56 pF 5% 400V | Arco DM15-560J | 200030 |
| C402 | " " | 250 pF 5% 500V | Arco DM15-251J | 200036 |
| C403 | " " | 0.02 µF 20% 500V | Erie 841Z5V203P | 224118 |
| C404 | " " | 0.02 µF 20% 500V | " | " |
| C405 | " " | " | " | " |
| C406 | " " | " | " | " |
| C407 | " " | 0.001 µF 500V | Erie 86125V | 224114 |
| C408 | " " | 10 µF 6V | Sprague TE-1087 | 283130 |
| C409 | " " | 20 µF 6V | Sprague TE-1090 | 283153 |
| C410 | " " | 0.01 µF 10% 200V | Sprague 192P10392 | 234027 |
| C411 | " " | 1.0 µF 100V | Sprague TE-1400 | 283175 |
| C412 | " " | 25 µF 6V | Sprague TE-1091 | 283177 |
| | | | | |
| C501 | " " | 0.1 µF 10% 200V | Sprague 192P10492 | 230116 |

| Reference | | Description | Mfr. | Part Number |
|---|---|---|---|---|
| C601 | Capacitor, Fixed | 0.01 μF 10% 600V | Sprague 220P 6PS-10 | 234077 |
| C602 | " " | " | " | " |
| C603 | " " | 50 μF 12V | Sprague TE-1133 | 283176 |
| C604 | " " | 20/20 μF 450V | Mallory FP-134 | 283100 |
| **DIODES** | | | | |
| D201 | Diode, Silicon | 1N251 | T.I. | 530043 |
| D202 | " " | " | " | " |
| D203 | " " | " | " | " |
| D204 | " " | " | " | " |
| D301 | Diode, Silicon | 1N914 | T.I. | 530058 |
| D302 | " " | " | " | " |
| D401 | Diode, Silicon | 1N251 | T.I. | 530043 |
| D402 | Diode, Zener, 7.5V 5% | 1N755A | Motorola | 530066 |
| D403 | Diode, Silicon | 1N251 | T.I. | 530043 |
| D404 | " " | " | " | " |
| D405 | " " | " | " | " |
| D406 | " " | " | " | " |
| D501 | Diode, Silicon | 1N2070 | | 530088 |
| D601 | Diode, Silicon | 1N251 | T.I. | 530043 |
| **FUSES** | | | | |
| F101 | Fuse | 1/4 Amp 250V | Bussman AGC-1/4 | 545506 |
| F601 | Fuse, Slo-Blo | 0.5 Amp 250V (117V Units) | Bussman MDL | 545504 |
| | | 0.25 Amp 250V (230V Units) | " | 545511 |
| F602 | Fuse, Slo-Blo | 0.25Amp 250V (117V Units) | Bussman MDL | 545511 |
| | | 1/8 Amp 250V (230V Units) | " | 545516 |

| Reference | Description | Mfr. | Part Number |
|---|---|---|---|
| **INDUCTORS** | | | |
| L101 | Coil Unit | | 400123 |
| L102 | " " | | 400122 |
| L103 | Toroid Coil Assembly | | 071176 |
| L104 | Choke, 220μH 5% | Nytronics Wee-220 | 400118 |
| L105 | " " | " | " |
| L201 | | | |
| L202 | Choke, 1000μH 5% | Nytronics | 400095 |
| L203 | Coil, Interstage | | 400221 |
| L204 | " " | | " |
| L205 | Choke, 220μH 5% | Nytronics | 400118 |
| L206 | Choke, 47 μH | Miller 9210-60 | 400076 |
| L301 | Choke, 4.7 mH 5% | Nytronics RFC-L-10000 | 400102 |
| L501 | Choke, 4.7 mH 5% | Essex RFC-14700 | 400102 |
| L601 | Choke, 7 H 50mA dc 550 ohms | Stancor C1707 | 440001 |
| **TRANSFORMERS** | | | |
| T101 | Input Transformer Assembly | | 071012 |
| T201 | Output transformer Assembly | | 071183 |

| Reference | Description | Mfr. | Part Number |
|---|---|---|---|
| **TRANSFORMERS** | | | |
| T301 | Phase Detector Transformer Assembly | | 071184 |
| T401 | Oscillator Transformer Assembly | | 071008 |
| T601 | Power Transformer | | 446025 |
| **VACUUM TUBES** | | | |
| V201 | Tube, 6CB6 | RCA | 5266CB6 |
| V202 | " " | " | " |
| V203 | " " | " | " |
| V301 | Tube, 6CB6 | RCA | 5266CB6 |
| V401 | Tube, 6BE6 | RCA | 5266BE6 |
| V402 | Tube, 12AX7 | Telefunken | 525001 |
| V601 | Tube, 6X4 | Envelope size JETEC-5-3 | 5266X4 |
| **CRYSTALS** | | | |
| Y401 | Crystal, 1 MHz Type CR-37/U | J. Knight HC-131V | 547015 |

PARTS LIST
DIGITAL DISPLAY UNIT 94B

| Reference | | Description | Mfr. | Part Number |
|---|---|---|---|---|
| R701 | Resistor | 1MΩ 1% | T.I. MC60D | 326700 |
| R702 | " | 1.3MΩ 5% 1/2W | AB Type EB | 301162 |
| R703 | " | 100K to 100.5K (8) | | 340911 |
| | | or | | |
| | | 100.5K to 101K (9) | | 340910 |
| | | or | | |
| | | 99.5K to 100K (10) | | 340909 |
| | | or | | |
| | | 99K to 99.5K (11) | | 340908 |
| R704 | Potentiometer | 1000Ω 20% | CTS 360T-360PC102B | 311257 |
| R705 | Resistor | 10,200 to 10,251 (4) | | 340907 |
| | | or | | |
| | | 10,251 to 10,302Ω (5) | | 340906 |
| | | or | | |
| | | 10,149 to 10,200Ω (6) | | 340905 |
| | | or | | |
| | | 10,098 to 10,149Ω (7) | | 340904 |
| R706 | Potentiometer | 100Ω 20% | CTS 360T-360PC101B | 311258 |
| R707 | Resistor | 1100 to 1105.5Ω (0) | | 340903 |
| | | or | | |
| | | 1105.5 to 1111Ω (1) | | 340902 |
| | | or | | |
| | | 1094.5 to 1100Ω (2) | | 340901 |
| | | or | | |
| | | 1089 to 1094.5Ω (3) | | 340900 |

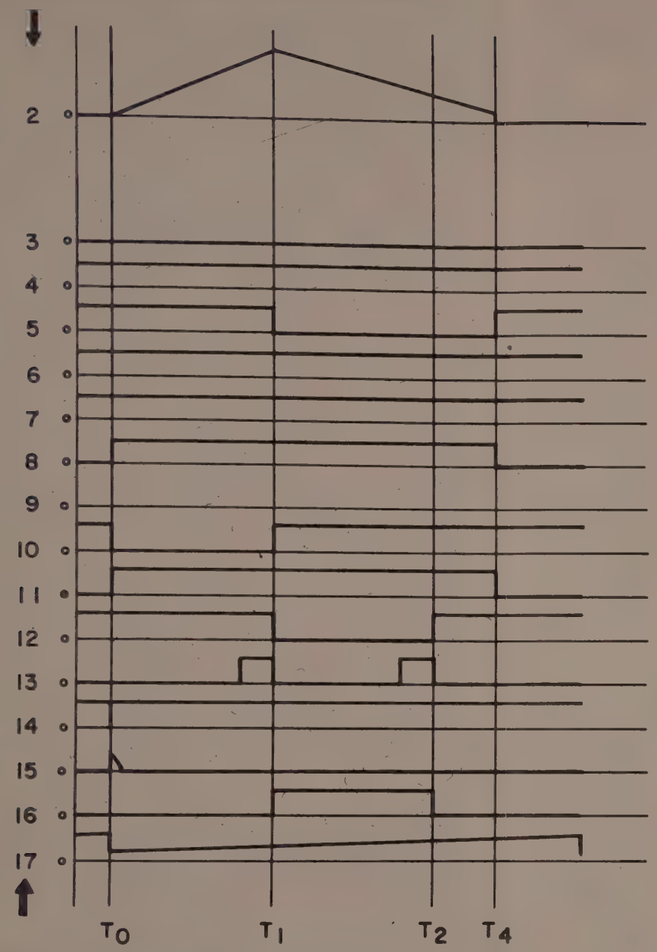
NOTE: Resistors R703, R705 and R707 must be of the same number group in any particular instrument, i.e. 1-5-9 : 0-4-8 : 2-6-10 OR 3-7-11

| | | | | |
|---|---|---|---|---|
| R708 | Resistor | 18Ω 5% 1/2W | AB-EB | 301045 |
| R709 | " | 22Ω 5% 1/2W | AB-EB | 301047 |
| R710 | " | 1000Ω 5% 1/2W | " | 301087 |
| R711 | " | 1.2KΩ 5% 1/2W | " | 301089 |
| R712 | | 10KΩ 5% 1/2W | " | 301111 |

| Reference | | Description | Mrf. | Part Number |
|---|---|---|---|---|
| R713 | Resistor | 10K 5% 1/2W | AB-EB | 301111 |
| R714 | " | 330Ω 5% 1/2W | " | 301075 |
| R715 | " | 100KΩ 5% 1/2W | " | 301135 |
| R716 | " | 6.04K 1% | T.I. MC60D | 340333 |
| R717 | " | 180KΩ 5% 1/2W | AB-EB | 301141 |
| R718 | Potentiometer | 1KΩ ±5% Lin. ±0.25% 10 turn | Bourns 3509S-1-102 | 311261 |
| R719 | Potentiometer | 10KΩ ±5% Lin. ±0.25% 10 turn | Bourns 3509S-1-103 | 311260 |
| R720 | Potentiometer | 100KΩ -5% Lin. -0.25% 10 turn | Bourns 3509S-1-104 | 311259 |
| R721 | Resistor | 100Ω 5% 1/2W | AB-EB | 301063 |
| R722 | " | 1KΩ 5% 1/2W | " | 301087 |
| C701 | Capacitor | 10μF 250V | Sprague TVA 1504 | 283210 |
| C702 | " | 10pF 500V 5% | Arco DM-10C-100J | 200022 |
| C703 | " | 10μF 250V | Sprague TVA 1504 | 283210 |
| C704 | " | 240 pF 500V 5% | Arco DM15-241J | 200506 |
| C705 | " | 10 μF 250V | Sprague TVA 1504 | 283210 |
| C706 | " | 0.1 μF 25V | Erie 5815-000-104Z | 224124 |
| C708 | " | 1000 μF 50V | Sprague TVL 1338 | 283201 |
| C707 | " | 200 μF 250V | Sprague TVL 1547 | 283209 |
| C709 | " | 0.1 μF 200V 10% | Sprague 192P10492 | 230116 |
| CR701 | Diode, Silicon | 1N2070 | | 530088 |
| CR702 | " " | " | | " |
| CR703 | " " | " | | " |
| CR704 | " " | " | | " |
| CR705 | " " | " | | " |
| CR706 | " " | " | | " |
| CR707 | " " | " | | " |
| CR708 | " " | " | | " |

| Reference | | | Description | Mfr. | Part Number |
|---|---|---|---|---|---|
| CR709 | Diode, | Silicon | 1N2070 | | 530088 |
| CR710 | " | " | " | | " |
| CR711 | " | " | | | " |
| CR712 | " | " | " | | " |
| CR713 | " | " | " | | " |
| Q701 | Transistor, NPN Silicon | | | Motorola MJE340 | 528040 |

Test Points on Schematic Diagram 830454B

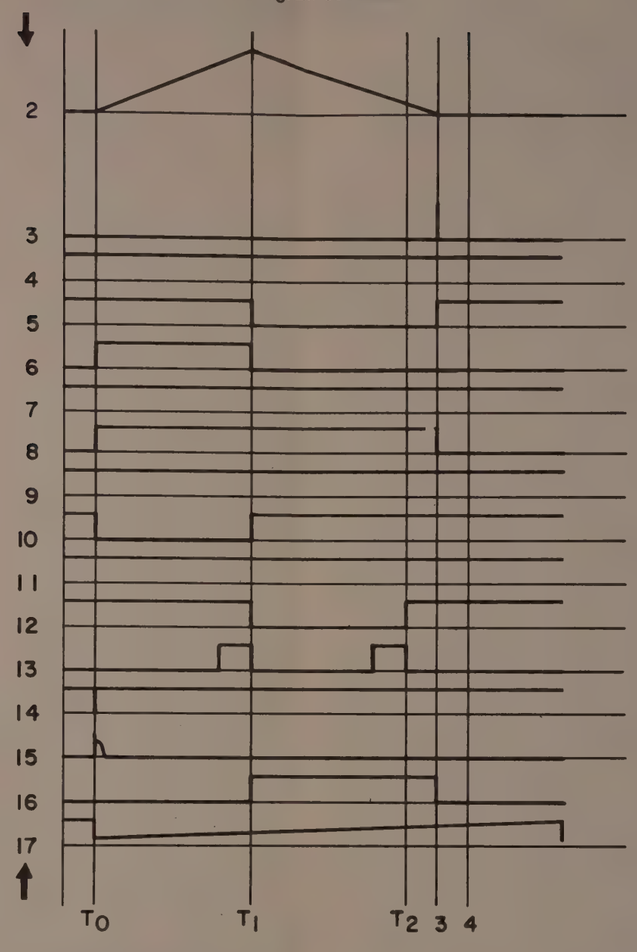



TIMING DIAGRAM 1

+1.5 VOLT INPUT - LOGIC TESTING
TO = RESET
T1 = 10,000 COUNTS
T2 = SECOND 10,000 COUNTS
T4 = SHUTDOWN AT 24,000 TOTAL COUNTS

NIXIES SHOULD NOT BE LIT, O/R LAMP SHOULD BE ON.

Test Points on Schematic Diagram 830454B

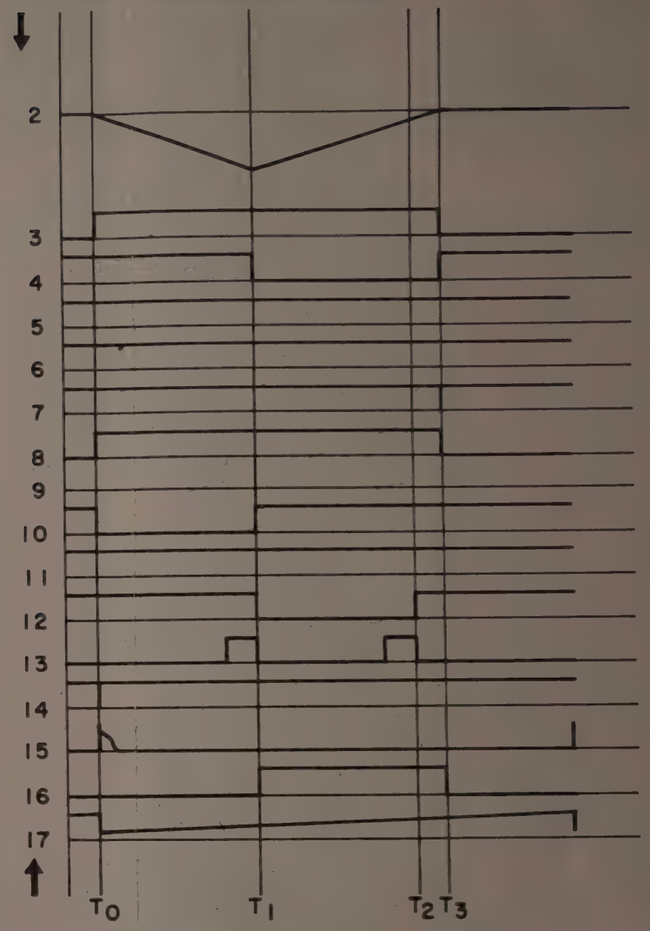



TIMING DIAGRAM 2

+1.2 VOLT INPUT
TO = RESET
T1 = 10,000 COUNT REFERENCE
T2 = SECOND 10,000 COUNTS
T3 = SHUTDOWN AT 22,000 TOTAL COUNTS

NIXIES SHOULD REMAIN LIT.

Test Points on Schematic Diagram 830454B



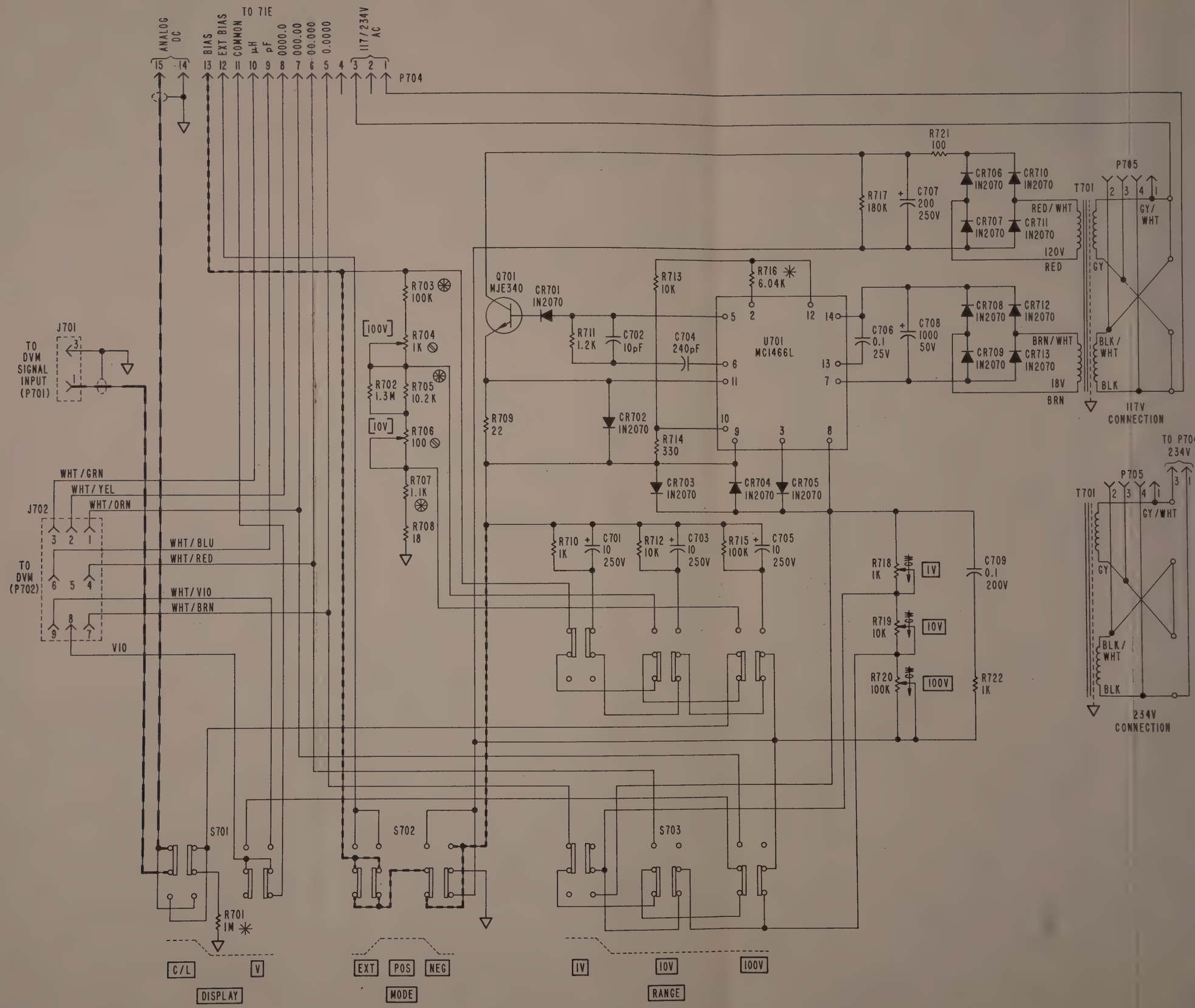

TIMING DIAGRAM 3

-1.2 VOLT INPUT

SIMILAR TO +1.2V INPUT, BUT - SIGN SHOULD LIGHT.

TEST POINT ONE, OUTPUT OF A1, SHOULD ALWAYS BE AT $-5E_{IN}$, FOR ALL $E_{IN}$ BELOW 2 VOLTS.

THE PEAK VALUE OF THE RAMP AT T.P.2 SHOULD BE APPROXIMATELY $7E_{IN}$ BELOW 1.5 VOLTS.




NOTES:

1. CAPACITANCE VALUES IN µF, UNLESS OTHERWISE SPECIFIED.
2. RESISTANCE VALUES IN OHMS AND 1/2 WATTS, UNLESS OTHERWISE SPECIFIED.
3. SWITCHES SHOWN IN C/L POSITION AND 1 VOLT POSITIVE INTERNAL BIAS.
4. ✳ PRECISION RESISTOR.
5. ⊛ FACTORY SELECTED PRECISION RESISTOR.
6. ——— ANALOG DC SIGNAL
7. - - - - - DC BIAS
8. ▭ EXTERNAL MARKINGS
9. [ ] INTERNAL MARKINGS
10. ⊘ INTERNAL CONTROL
11. ▽ COMMON
12. LAST NUMBERS USED:
    R722, C709

BOONTON ELECTRONICS CORPORATION

MODEL 700C
Schematic, Bias Supply
830453C

MEASURING NETWORKS

1MHz AMPLIFIER

1MHz CRYSTAL OSC. AND CONTROL AMPLIFIER

REFERENCE AMPLIFIER AND PHASE DETECTOR

DC OUTPUT CIRCUITS

POWER SUPPLY

PRIMARY WIRING FOR 234V 50-60Hz OPERATION

NOTES:
1. CAPACITANCE IN µF, UNLESS OTHERWISE SPECIFIED.
2. VOLTAGE RATING OF CAPACITORS IS 500V, UNLESS OTHERWISE SPECIFIED.
3. RESISTANCE VALUES IN OHMS AND 1/2 WATT, UNLESS OTHERWISE SPECIFIED.
4. ⊛ FACTORY SELECTED VALUE.
5. ✳ PRECISION RESISTORS
6. ▭ EXTERNAL MARKINGS.
7. [ ] INTERNAL MARKINGS.
8. LAST NUMBERS USED:

| | |
|---|---|
| R119 | C115 |
| R221 | C218 |
| R307 | C308 |
| R428 | C412 |
| R508 | C501 |
| R605 | C604 |

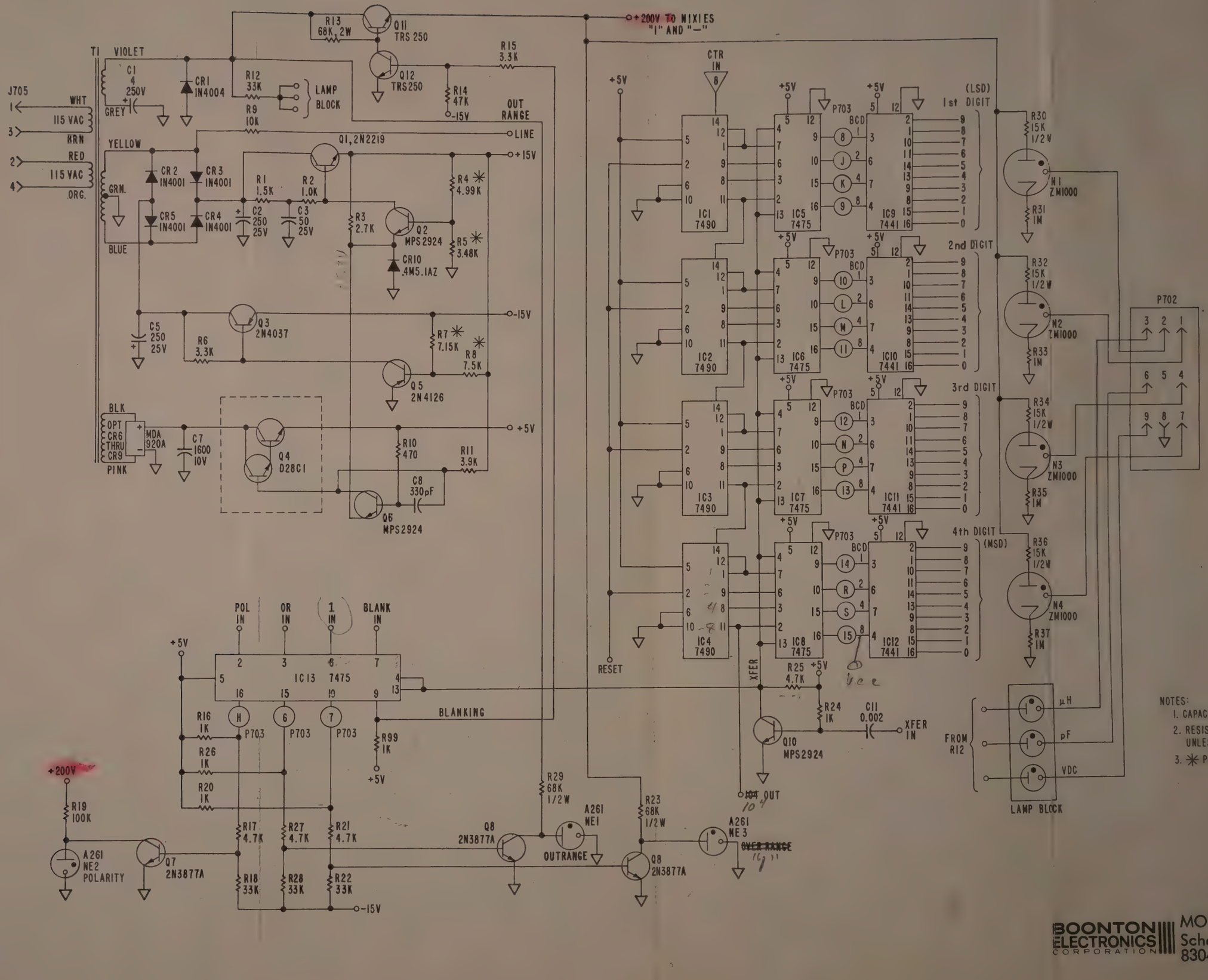
9. NUMBERS NOT USED:

| | |
|---|---|
| R103 | R110 |
| R105 | R112 |
| R107 | R114 |
| R108 | R118 |
| R109 | R412 |

10. ——— SIGNAL PATH.
11. – – – SECONDARY SIGNAL.
12. ——— FEED BACK PATH.

BOONTON ELECTRONICS CORPORATION

MODEL 700C
Schematic, C/L Ref. Unit
830452D




NOTES:
1. CAPACITANCE IN μF, UNLESS OTHERWISE SPECIFIED.
2. RESISTANCE VALUES IN OHMS & 1/4 WATT, UNLESS OTHERWISE SPECIFIED.
3. ✳ PRECISION RESISTORS.

BOONTON ELECTRONICS CORPORATION

MODEL 700C
Schematic, Digital Display Unit
830454D (Sh. 1 of 2)

P701
HI
SIGNAL IN
LO
R38 1M
CR11 1N457
CR12 1N457
A1 (801)
C15 0.01
R41
C14 200pF
R42 47
C12 0.001
R39 825K
R40 1.5K
C13 0.002
DVM ZERO R45 10K
+6V -6V
0.025 C24
R46 5M
R84 10K
R85 56K
R86 100K
Q22 2N4126
R43 49.9K
Q13 2N4393
C16 1 50V
Q15 2N5457
-15V
R83 100K
R82 56K
R81 10K
Q21 2N4126
C17 22pF
R49 47
K50 1.10K
1C14 MC1437
R48 1.5K
C18 0.001
R47 49.9K
C19 0.001
C21 0.1 20V
C22 0.1 20V
C23 3.3pF
CR13 1N914
CR14 1N914
R51 1.10K
R52 249K
R53 100
C29 15pF
R54 3.9K
R55 330
C31 0.005
CR16 1N914
5V
1C17 MC862P
1C18 MC846P
C25 330pF
1C19
R56 15K
R67 1K
1C15 MC846P
1C16 MC846P
MC846P
MC836P
R61 2.2K
C26 0.01 100V
R57 1K
R58 1K
R59 1K
R60 1K
R87 10K
R88 56K
R89 100K
Q23 2N4126
Q16 2N4093
R63 1.10K
R64 100K
F.S. +1V
R68 200
R69 49.9K
CR15 1N829
R70 4.99K
R71 4.99K
F.S. -1V
R72 200
R73 49.9K
R74 1.00K
R65 15K
R66 15K
R67 7.50K
Q17 2N4093
Q24 2N4126
R92 100K
R92 56K
R90 10K
1C20 MC845P
1C19 MC836P
R75 22K
C27 0.001
R76 300K
R77 1K
R9 10K
Q18 MPS2924
Q19 2N4870
C30 35V
R79 270
C28 0.002
R80 4.7K
R78 4.7K
Q20 MPS2924
CR17 1N457
LINE
P703
E
HOLD
RESET
"1"
END OF ENCODE
4000
OUT RANGE
BLANK
CTR
XFMR
POL
This cap should be added to stop digit (glitches)
start Gen. circuit

NOTES:
1. CAPACITANCE VALUES IN µF, UNLESS OTHERWISE SPECIFIED.
2. RESISTANCE VALUES IN OHMS & 1/4 WATT, UNLESS OTHERWISE SPECIFIED.
3. ⊛ FACTORY SELECTED VALUE.
4. ✳ PRECISION RESISTORS.
5. ◯ TEST POINTS

BOONTON ELECTRONICS CORPORATION
MODEL 700C
Schematic, Digital Display Unit
830454C (Sh. 2 of 2)

# Warranty

Boonton Electronics Corporation warrants its products to the original Purchaser to be free from defects in material and workmanship and to operate within applicable specifications for a period of one year from date of shipment, provided they are used under normal operating conditions. This warranty does not apply to vacuum tubes that have given normal service, to sealed assemblies which have been opened, or to any item which has been repaired or altered without our authorization.

We will repair or, at our option, replace at no charge any of our products which are found to be defective under the terms of this warranty. Except for such repair or replacement, we will not be liable for any incidental damages or for any consequential damages, as those terms are defined in Section 2-715 of the Uniform Commercial Code, in connection with products covered by this warranty.

BOONTON ELECTRONICS CORPORATION

Telephone: 201-887-5110
TWX: 710-986-8241

Route 287, Parsippany, N. J. – 07054

# CALIBRATION OF THE BOONTON 700C

## BOONTON CAPACITANCE MEASURING SYSTEM

(Make sure CAL 1 & CAL 2 are in the middle of their ranges)

1. Check that the 1000pf full scale range is capable of several pf overrange. if it is not, (after properly zeroing and adjusting compensation) turn Cal 1 so it can be, after turning C1000 adjust to max.
2. After zeroing on 10pf range and adjusting for zero on 1000pf range with 1000pf ZERO adjust, (with standard hooked up), calibrate the 100pf range with the 100pf adjust. With the 10pf adjust and ;the 1000pf adjust, adjust and calibrate other two ranges.
3. Turn switch to CAL 1 and adjust readout to 100.00 with CAL 1 adjust (located thru hole above "OPERATE-CAL1-CAL2" switch.
4. Turn switch to CAL 2 and adjust readout to 100.00 with CAL 2 adjust ( located thru other hole above "OPERATE-CAL1-CAL2" switch.

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